Electrical World

JULY 7
1945

British Grid's War Report

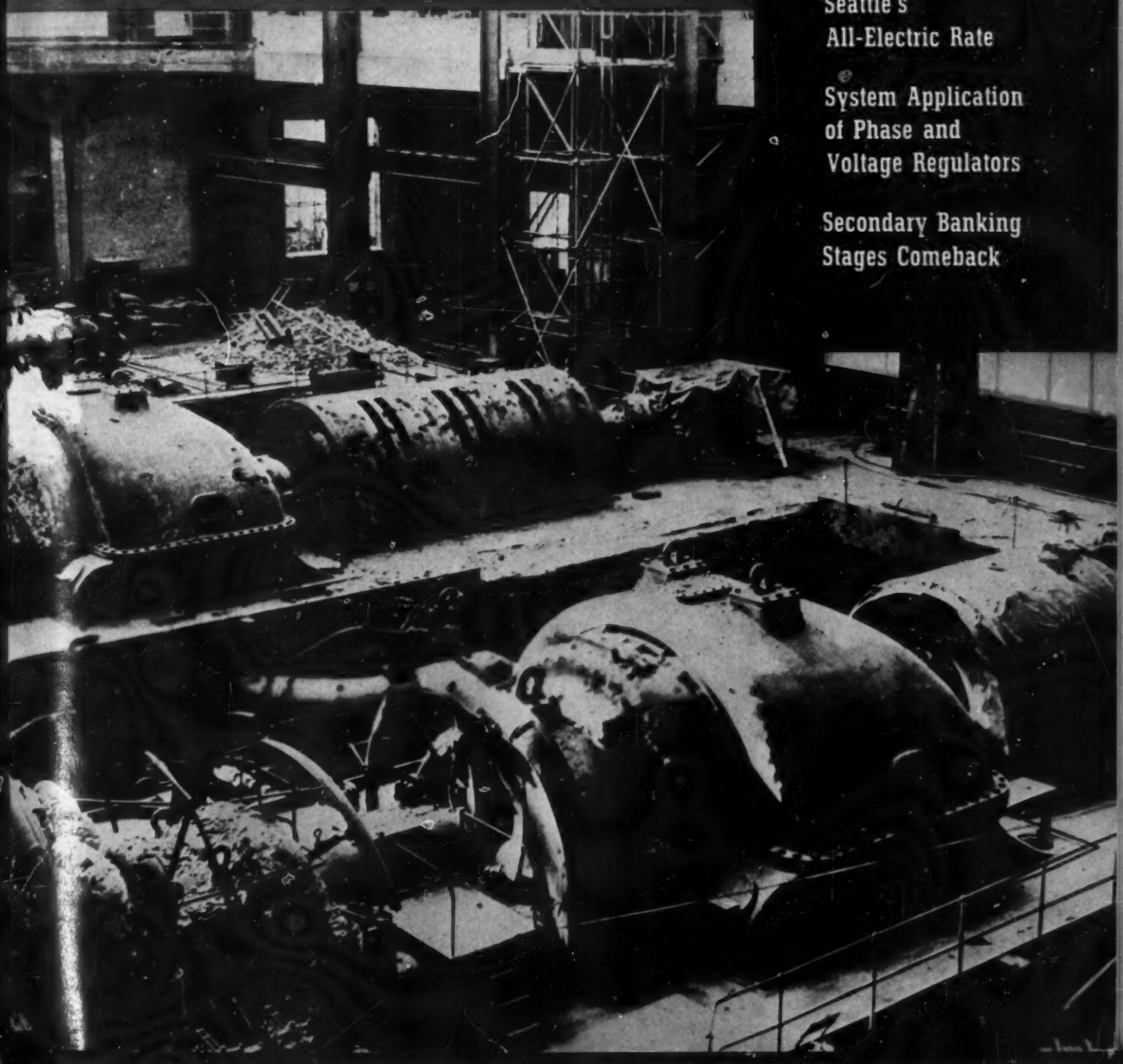
Operating Problems with War-Time Coals

Seattle's All-Electric Rate

System Application of Phase and Voltage Regulators

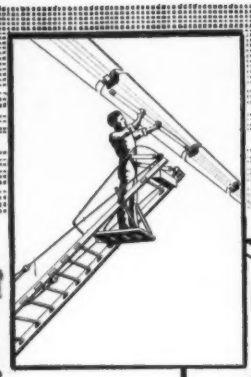
Secondary Banking Stages Comeback

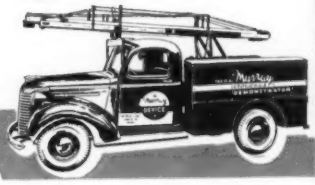
England's Most Serious Outage from Bombing



"High, wide" — yes, and "handsome", too!

The ladder that never interrupts production





Practically numberless working positions—many inclinations, height-variation foot by foot and full 360° rotation—all with practically automatic operation.

Crows'nests of varying heights, mounted on live skids, caster trailers, carriages, motor trucks or other suitable bases are doing important up-in-the-air jobs — indoors and outdoors — speedily, efficiently, safely. Fluorescent lights mounted over machines or benches are serviced without interrupting production.

Crows'nests are mighty useful, too, for inspecting, building, servicing and repairing planes in nearly every manufacturing plant and at airport after airport. For proposal, specify working height, sideways-reach and aisle-width, if any. No obligation. Metropolitan Device Corporation, Brooklyn 16, N. Y.

Murray crow's'nest

ACCLAIMED AMERICA'S No. 1 MAINTENANCE LADDER — *for indoors and outdoors*

Send for informative technical data

Electrical World

FOUNDED IN 1874 • READ BY ELECTRICAL MEN FOR 71 YEARS

July 7, 1945

Vol. 124, No. 1

Contents

Secondary Banking Stages A Comeback 92
R. R. MENARD, Western Massachusetts Electric Co.

Effect of War on British Grid 96

7,438 Kw.-Hr.—$80 Revenue from Seattle's All-Electric Rate 100
FRED KNAUS, Dept. of Lighting, City of Seattle, Wash.

Handling War Time Coals in Boiler Plants 103

System Application of Phase and Voltage Regulators 104
A. A. JOHNSON, Westinghouse Electric Corp.

Editorials ..... 91 and 108

Washington Comment 110

News of the Week 111

HOW 119

Load Servicing 144

New Equipment 150

News About People 158

Manufacturing and Markets 174

Sales Opportunities 180

Recent Rate Changes 184

Rural Allotments 185

Letters to the Editor 188

Index of Advertisements 194

S. B. WILLIAMS ..... *Editor*

A. E. KNOWLTON ..... *Associate Editor*
FRANK R. INNES ..... *Associate Editor*
R. M. SHOOP ..... *Assistant Editor*
JULIUS C. MEIER ..... *Assistant Editor*
KENNETH K. KOST ..... *News Editor*
E. M. GLENNON ..... *Assistant News Editor*
D. T. BRAYMER ..... *Western Editor*
H. S. KNOWLTON ..... *New England Editor*
W. C. HESTON ..... *Pacific Coast Editor*
R. N. LARKIN ..... *Washington Correspondent*

W. K. BEARD, JR. ..... *Publisher*

DISTRICT MANAGERS
E. F. COFFEY ..... New York
N. V. PALMER ..... Boston
F. P. COYLE ..... Philadelphia
W. W. GAREY ..... Cleveland
S. H. BABCOCK ..... Detroit
W. H. MENEILLEY ..... Chicago
J. T. SCHAEFER ..... St. Louis

ELECTRICAL WORLD

Published weekly. Price 25 cents a copy. Publication office 99-129 N. Broadway, Albany 1, N. Y. Allow at least ten days for change of address. Address communications about subscriptions to Director of Circulation, Electrical World, 330 West 42nd Street, New York 18, N. Y.

RETURN POSTAGE GUARANTEED

Subscription rates: In the United States, Mexico, Central and South American countries, $5 a year, $8 for two years, $10 for three years; Canada, $6 for one year, $10 for two years, $12 for three years (Canadian money at par). Great Britain and British possessions, 60 shillings for one year, 120 shillings for three years. All other countries $9 for one year, $18 for three years. Please indicate position and company connection on all subscription orders. Entered as second class matter November 16, 1936, at Post Office at Albany, N. Y., under the Act of March 3, 1879. Printed in U. S. A.

Contents copyrighted, 1945, by McGraw-Hill Publishing Company, Inc. Branch Offices: 520 North Michigan Avenue, Chicago 11, Ill.; 68 Post Street, San Francisco 4; Aldwych House, Aldwych, London, W.C. 2; Atlanta, Ga.; Boston, Cleveland, Detroit, Los Angeles, Philadelphia, Pittsburgh, St. Louis, Washington.

McGRAW-HILL PUBLISHING CO., INC.
JAMES H. McGRAW
Founder and Honorary Chairman

Publication Office
99-129 North Broadway, Albany 1, N. Y.

Editorial and Executive Offices
330 West 42nd St., New York 18, N. Y.

JAMES H. McGRAW, JR. ..... President
CURTIS W. McGRAW ... Senior Vice-President and Treasurer
HOWARD EHRLICH ..... Vice-President (for Business Operations)
JOHN ABBINK ..... Vice-President (for Editorial Operations)
JOSEPH A. GERARDI ..... Secretary
J. S. BLACKBURN, JR. ... Director of Circulation

Member A.B.P. Member A.B.C.
Cable Address McGRAW-HILL, New York

The contents of this issue are copyrighted and may not be reproduced without the permission of the copyright owners.

CHANGE OF ADDRESS

McGRAW-HILL PUBLISHING COMPANY,
330 West 42nd Street, New York 18, N. Y.
Director of Circulation:

Please change my address on Electrical World

Name .....

Old Address .....

New Address .....

New Company Connection .....

New Title or Position .....

CABLE LIFE "PRE-VIEWED" BY YEARS OF EXPOSURE

Okonite's Proving Ground Duplicates Actual Operating Conditions

All kinds of weather and four kinds of soil provide thoroughgoing performance "pre-views" at the cable proving ground at The Okonite Company's Passaic, New Jersey plant.

About to start its ninth year of carefully-recorded cable service studies, this unique *outdoor laboratory* is dedicated to evaluating the useful life of all types of insulation both above and below ground under all severe operating conditions. Believing that time and time alone is the only true means of determining what a cable will do, Okonite engineers put principle into practice with the realistic creation of actual service conditions rather than artificial "accelerated aging".

Buried directly in various types of earth, pulled into conduit or installed overhead — network, control, primary distribution and portable power cables are constantly operating under controlled conditions of temperature, voltage and loading.

At specified intervals they are taken up, sections cut from the cable and detailed tests conducted under the independent supervision of The Electrical Testing Laboratories.

Test Conditions

Cables under test are installed in four concrete troughs, each 50 ft. long by 4 ft. wide and 4 ft. deep. These troughs, open at the bottom, are each filled with a different type of soil:

1. Top soil saturated with corrosive water from a manhole.
2. Soil with a layer of manure over the cables to simulate conditions of decaying organic matter.
3. A mixture of 99 lb. of sand and 1 lb. of lime which is subjected to a periodic pH test and maintained highly alkaline.
4. Soft-coal cinders regularly wet with a sulphuric acid solution to render them positively acid. Given a regular pH test and acidity maintained.

Cables in each trough are in two layers, Spacing of cables was selected to allow control and signal cables to be slightly warmed by network cables which are subjected to current loading. The majority of cables are buried between 30 in. and 36 in. deep.

Buried Since 1937

Four main types of cables are installed in the troughs in the proving ground.

1. Network cables. Nine cables representing all constructions, including fibrous and rubber covered; 250,000 circ. mil. single-conductor, insulated for 600 volts, operating at 120 volts and loaded in cycles nine hours a day, five days a week, to give a copper temperature of approximately 60 deg. C. Network cables in all troughs are in series across 120 volts.
2. Control cables. Eleven seven-conductor, rubber insulated cables with various types of metallic and non-metallic sheaths in each trough energized at 120 volts but not loaded.
3. Underground primary distribution cable. Four different commonly-used types of 5-kv. non-metallic sheath cable in each trough energized at 7.6-kv. but not loaded. Each trough contains 50-ft. lengths of each type of cable.
4. Portable high-voltage cable. Two types, shielded and non-shielded, 12.5-kv. three-conductor, dredge or shovel cables run at random in the yard on the top of the ground and moved each week. Two types are connected in series and ends connected to 12.5-kv. busbars.

In addition to the underground cables, two 30-ft. poles have been erected carrying more than a dozen types of insulated aerial cable and line and tree wire energized at 7.6-kv. from the busbar structure. Interconnecting these overhead "circuits" are three conduit risers on each pole containing four test cables each.

As tests are tabulated, valuable trends have already been disclosed. While eight years are too short for final conclusions, proving-ground results have indicated significant tendencies. For example, in the case of exposed cables, Okolite-Okoprene (Patent 2,312,058) is showing to advantage over the fibrous type of rubber insulated cable which has suffered braid deterioration, tape erosion and corona cutting.

This is but one instance — one forerunner of benefits to come. As time goes on and more and more facts accumulate, Okonite engineers will be guided to a greater degree by this recorded test data, and will pass along greater service-life knowledge in the form of improved electrical wires and cables. The Okonite Company, Passaic, New Jersey.

Underground portion of proving ground at end of first full year of operation.

Cables are periodically exhumed, sections removed, ends sealed for reburial.

OKONITE insulated wires and cables

Electrical World
JULY 7, 1945

Competition

ONE OF THE FINEST THINGS that could happen to the electric utility business would be for the public to believe that the power companies have competition. Thoughtful utility men realize that and yet the industry somehow seems to resent competition. Why is it?

Electric service has always been a competitive service. It has thrust other services aside because it was quicker, or cheaper, or more flexible, or better in any one of many ways. It has taken the place of oil and gas for lighting, ice for refrigeration, steam for industrial power, to mention some of the more obvious. Its whole advance has been through making something else obsolete because electricity could do the job so much better.

Any attitude of resentment can spring only from monopolistic thinking which in itself is contrary to the best interests of the industry; because all private monopolies are destined to crash sooner or later. As a matter of fact, the industry needs competition as a stimulus. Without competition the utilities would undoubtedly be far less advanced than they are. Indeed, a little more competition might even be beneficial.

As a matter of fact, there is more competition than most people in the industry see and that is what must be met. One sales manager recently said that there were twenty-one spots in the home that needed lighting. Wiring of already built homes is woefully inadequate. The farms are asking for electric service, yet only about half are served. Virtua all pre-war lighting is out of date.

There is the real competition but it hasn't seemed to stimulate great effort. It would, however, in a hurry if some other service were offered to do that work, or if someone else came in to serve a load that the industry was going to serve at some uncertain time in the future. Therefore, the industry should not resent competition, but should welcome it as a provider of incentive.

To deny that diesels, packaged power, bottled gas, manufactured gas are competitive would be silly, but it is far worse not to recognize the competition that arises from insufficient vision. The opportunities for load growth are all around us. Monopolistic operation offers no incentive, particularly when its return is limited; only enterprise operated on the principles of competition will see such opportunities.

In other words, the industry needs sales goals based not on what it thinks it can do comfortably because that will merely repeat the slow pace of monopoly. It needs goals that will strain every mental muscle, every bit of ingenuity, every ounce of vision.

If hard-to-reach sales objectives are set then the industry will look for more things to sell and, if it doesn't find them readily in the new and dramatic then it will turn to the business that it has not been fully developing, the business that is the real competition because it has defied electricity.

Competition isn't only that which tries to take business away from one. In the case of electricity, the worst competitor is that which resists the utilization of power. By all means, try intelligently to prevent loss of business to any competitive source of power, but at the same time reserve any resentment for the inertia that holds the industry back from setting up the kind of objective it would have if it were thinking as a progressive competitive industry instead of as a regulated monopoly.

Secondary Banking Stages a Comeback

Flicker voltage dips may be cut 50 percent—Effect of spot demands on regulation better controlled as heavy duty appliance use increases—Loads better balanced and outages reduced

R. R. MENARD, Distribution Engineer, Western Massachusetts Electric Co., Springfield, Mass.

DESPITE FORMER HANDICAPS in trouble cascading, service restoration and satisfactory fusing, secondary banking is now being more widely adopted. Multiplied motor-driven appliances and greater use of ranges calls for better voltage regulation to do away with flicker complaints. In isolated cases static condensers and autotransformers appear useful, but a more general solution is offered by banking. Modern fuses have greater accuracy and reliability than older ones. With a straight line bank instantaneous voltage dip from motor starts may be cut 50 percent, and still more with a grid system. The problem cannot economically be met by radial secondaries.

Selection of banking type is largely based on the relative values of regulation, load diversity, service continuity and the cost of more serious interruptions and their prevention. Types may be (a) straight line; (b) complete loop; (c) grid.

The straight line bank may utilize two or more transformers whose secondaries are connected end to end with outside ends free. This is the simplest and widest used scheme, but as the outside ends do not have banking benefits, the method is not 100 percent efficient. If the two outside ends are tied together we obtain a loop where all sections of the secondary have about the same advantages. Protection on the loop is as easy as on the straight line, (it is no more complicated to calculate voltage drops or fault currents) and the scheme is preferable where layouts permit.

The grid system where the secondaries are connected in all directions to adjacent secondaries usually involves many more transformers. The large number of possible fault conditions makes the calculating board useful in determining possible fault currents. The scheme is by far the best for the results obtained. Estimation of fault currents is not as difficult as at first appears, due to the high impedance of overhead secondaries, which limits the fault current to that from transformers not over about 3,000 ft. distant with No. 2 copper.

Merits of Banking

Normal distributed load automatically divides to a major degree among the transformers giving the best regulation.

With evenly distributed load, the minimum load point would fall half way between two transformers of the same size; but under field conditions with loads of varying size and character, low load points may occur anywhere along the secondary.

Improved regulation is especially valuable with electric ranges, which create heavy spot demands that may be at the end of the secondary.

Secondary banking divides the load between two or more transformers with subsequent improved regulation. Unbalance is largely corrected, and demand diversity on adjacent transformers reduces peaks on individual units. This requires less transformer capacity for a stated overall load.

The ratio of installed distribution transformer capacity to primary feeder load may be brought even to unity without serious overloading.

With secondary banking more capacity is available to burn clear a secondary or service wire fault, and with some designs a reduction in outages may be had by clearing a faulty transformer without service interruption.

Analysis of Banking Types

Fig. 1 shows the simplest type of banking, with protection by transformer primary fuse only. This will cascade. In a straight line or looped bank any transformer or secondary fault will involve all transformers.

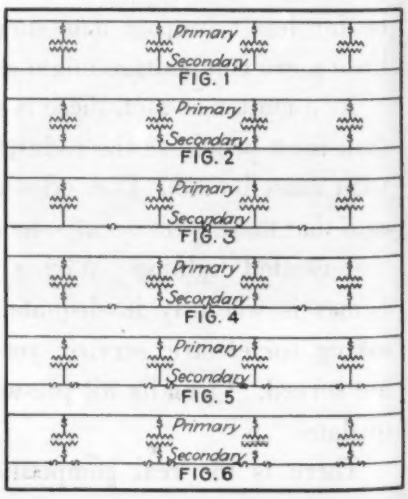


FIG. 1 to 6 inclusive: Schematic diagrams for fusing arrangements in various types of secondary banking

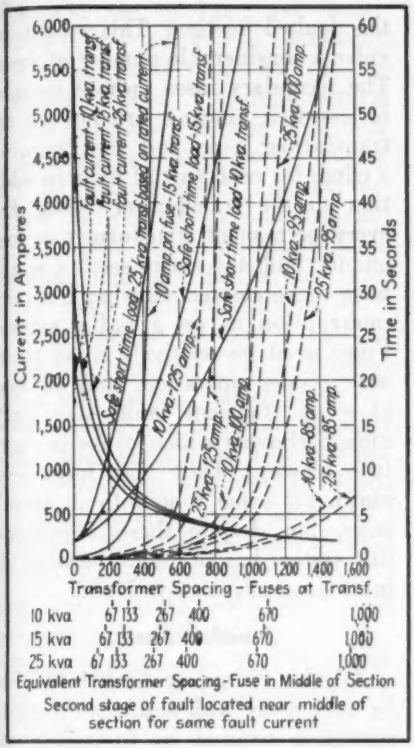

Current in Amperes
Time in Seconds
Transformer Spacing – Fuses at Transf.
10 kva 67 133 267 400 670 1,000
15 kva 67 133 267 400 670 1,000
25 kva 67 133 267 400 670 1,000
Equivalent Transformer Spacing – Fuse in Middle of Section
Second stage of fault located near middle of section for same fault current

FIG. 7—Secondary fault current variations with distances from transformer up to 1,500 ft. at 120 volts. Chart shows safe short-time overload transformer can withstand with these fault currents, with blowing times of 95, 100 and 125-amp. fuses to clear with this set-up. Thus, a 25-kva. transformer 500 ft. away has a fault current at 120 volts of about 580 amp. Safe short-time load period is 46 sec. An 85-amp. fuse would blow in about 0.3 sec., a 95-amp. fuse in 0.5 sec., a 100-amp. fuse in 0.75 sec., and a 125-amp. fuse in 1.7 sec. Current from other transformers in bank neglected; also equivalent distance for same fault current during second stage

The primary fuse will probably clear the adjacent transformers, but especially with a 120-volt fault primary fuses on more distant transformers will not blow, leading to a transformer failure and further cascading until all transformers are cleared.

Fig. 2 shows a bank with the addition of a secondary fuse installed in the transformer leads. Secondary faults may be expected to act as in the preceding case. Transformer faults, with proper fuse coordination, should clear without cascading. In a grid system there would probably not be as many faults burned clear, and the Fig. 1 set-up would give as good overall performance without the use of secondary fuses.

Fig. 3 illustrates the type of bank at present most popular. This is suited to those who desire to eliminate flicker troubles, but under fault conditions wish to revert to a radial system. Here a sectionalizing fuse about half way between adjacent transformers isolates faults on one section from adjacent sections. Such fuses must allow normal loads and overloads of short duration to flow, but must not permit damage or blowing of transformer primary fuses. They should coordinate with service entrance fuses so as not to blow from a fault on a customer's premises. Recommended practice rates the secondary

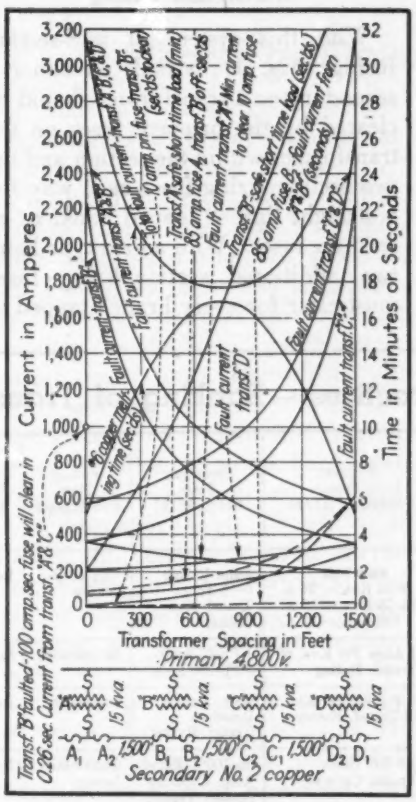


FIG. 8—Fault current values for four transformers along secondary section between transformers B and C, at 240 volts. Thus, at 750 ft., half-way between the two middle transformers, fault currents from B and C are about 625 amp., and from transformers A and D about 280 amp. each. Chart also shows safe short-time overload on transformers A and B, and the time required for melting No. 6 copper wire when carrying various currents

fuse at 75 to 100 percent of the rated secondary current of the smallest transformer of the two adjacent sections. With this type of bank a 240-volt fault will blow the primary fuse and two fuses both ways, isolating the section. With transformer spacing for good voltage regulation the short-circuit current will be ample for quick clearance. A 120-volt fault has two stages in clearing, and in the second stage the fault current may not be sufficient to blow the fuses as shown. (Fig. 7.)

Curves in Figs. 7, 8 and 9 show the maximum fault current obtainable with 10, 15 and 25-kva. transformers, with No. 2 copper, 8-in. secondary spacing, and transformer spacing up to 1,500 ft. (at any point between transformers) in the first stage of a fault. The equivalent spacing in the second stage is shown on Fig. 7. Thus it appears that for the same transformer spacing and secondary size, the size of the transformers does not affect the fault current to any great degree for the range of transformer spacing ordinarily found (from 500 to 1,500 ft.)

It follows, contrary to generally accepted conventional practice, that the size of the secondary sectionalizing fuse should not be determined by the size of the transformer or the rating of the smallest adjacent transformer, but by the size and spacing of the secondary conductors and the distance between transformers.

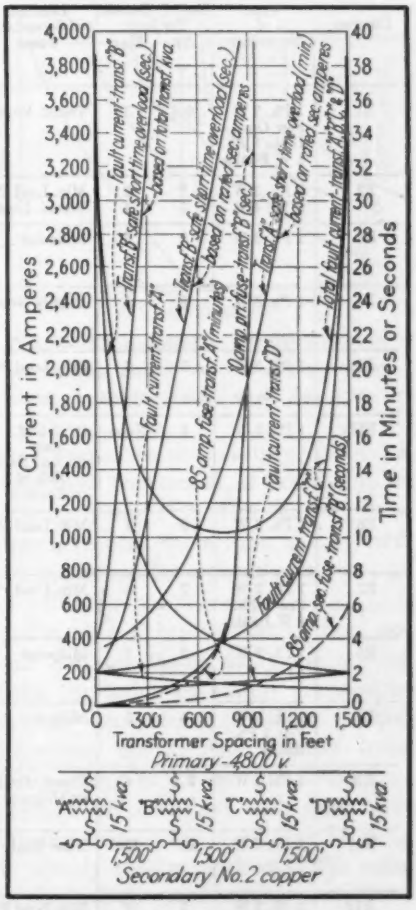


FIG. 9—Maximum short-circuit currents at 120 volts on secondaries, with transformer spacings up to 1,500 ft.

A comparison of the allowable spacing in the first stage and the equivalent electrical spacing allowable in the second stage, shows the reduction in spacing necessary for center-of-section fusing, assuming the same fuse rating, secondary size and load density. Thus a fault 1,000 ft. from a 25-kva. transformer will clear a 95-amp. fuse in about 4 sec. in the first stage, but will not clear the second stage. The equivalent distance for the same clearing time in the second stage is about 650 ft.

Time-current characteristics of various secondary fuses are also shown, the current being the maximum fault current available for the transformer size, secondary size and transformer spacing. This results in time-transformer spacing characteristic curves showing the minimum fuse clearing time to be expected with various spacings.

Experience indicates an economical spacing of transformers for a certain load density. With No. 2 copper secondaries designed for a 2 percent normal drop, the spacing for 1 kva. per 100 ft. is about 1,500 ft., and about 1,000 ft. for 2 kva. per 100 ft. These densities cover most residential areas except apartment house districts. With a radial system this spacing was often less due to spot loads near the ends causing too large a drop. The banked secondary realizes the economical spacing.

Mid-Section Fusing

With this system of mid-section fusing (Fig. 4), a fault on either a secondary or a transformer should be cleared by the primary fuses on the transformer within the section and the two sectionalizing fuses each way for a straight line or looped bank, or at least six fuses. With a grid type bank two additional sectionalizing fuses must clear for every branch tapped to the faulted section. This might involve a considerable number of fuses. The secondary fuses (whose location is less well known) are not on the transformer pole and that requires a climb for each pair of fuses in addition to the transformer fuses. For every permanent transformer or secondary fault the entire section would have to be cleared, causing a service interruption as on a radial system. Fuses must be relatively small to insure proper operation, and so may blow on transient faults like lightning flashovers which cause primary fuse blowing. They may have been blown for some time without knowledge, but despite these objections, this system has probably become the most generally accepted one.

Junction Fusing

All the foregoing limitations can be done away with and more positive operation secured by installing one

Summary of Fusing Practices — Banking of Transformers — 12 Companies

Company	Type of Secondary	No. of Transfs. Per Bank Av.	Max.	Location of Secondary Fuses	Primary Fuse Schedule (a) (b)	Secondary Fuse Schedule (b)	Fusing Plan Performance	Comparison of Service to Unbanked	Specific Experience Difficulties	All Primary Fuses Blown: Method of Restoring Service	All Primary Fuses Blown: Number of Occurrences
E1	1 Ph. 3 W Few Open Delta 3 Ph. 4 W Banks	6.4	12	Transf. leads	4800 Volt 5–15 Kva.— 24 A. 25–75 Kva.— 50 A. 100 Kva.— 75 A.	Amp. Rating 6–10 Times Transf. Kva. Rating	Very satisfactory	Better	None	Re-fuse Larger Transfs. or Pick Up Load in Sections	19 Cases in 7 Years
E2	1 Ph. 3 W 3 Ph. 4 W	2 3	2 4	Min. Load Pt. Transf. Leads	1 Amp. Per Kva. of Transf. Rating	1 Ph-45 Amp. 3 Ph-100 Amp.	As Intended	Same	None	Pick Up Load in Sections	None
E3	1 Ph. 3 W	3	5	Midpoint	1–2 Amp. Per Kva. of Transf. Rating	Amp. Rating Based on Transf. Rating	Successful	Improved	None	Pick Up Load in Sections	None
E4	1 Ph. 3 W	3	5	Usually None	2.5–3.5 Times Transf. Capacity	60–100% Rated Amp. Capacity Smaller Transf.	Quite Satisfactory	Not as Good	None	Pick Up Load in Sections	Few
E5A	1 Ph. 3 W	3	6	Min. Load Pt.	2.5 Times Transf. Capacity	Amp. Rating 5 Times Kva. Smallest Transf.	Satisfactory	.....	None	Pick Up Load in Sections	None
E5B	1 Ph. 3 W	6	None	(1) Transf. leads (2) And Each Side of Leads	4,800 Delta 0.6–1.0 Amp. Per Kva. Min.— 10 Amp.	(1) Based on Transf. Kva. (2) Based on Sec. Imp.	Satisfactory	Improved	None	Little Chance of Cascading	None
E6	1 Ph. 3 W	2	4	Min. Load Pt.	App. 1 Amp. Per Kva. of Transf. Rating	Generally 30 Amp.	As Expected	Improved	Primary Load Balancing a Problem	None — Not Anticipated	None
E7	1 Ph. 3 W Few 3 Ph. 4 W Banks	2	4	Min. Load Pt.	1 Amp. Per Kva. Min.— 10 Amp.	15 Amp.	Adequate	Same	None	None — Not Anticipated	None
E8	1 Ph. 3 W	2	4	Midpoint	1 Amp. Per Kva. Min.— 10 Amp.	2–5 Times Kva Smallest Transf.	As Intended	.....	Little Difficulty	Pick Up Load in Sections	None
E9	1 Ph. 3 W Few 3 Ph. Banks	3	5	Midpoint	App. 0.6–1.0 Amp. Per Kva.	1.5–5 Times Transf. Kva.	As Intended	Not as Good	One Case	None — Not Anticipated	None
E10	1 Ph. 3 W	2.5	4	Transf. Leads or Midpoint	0.75–1.0 Amp. Per Kva.	Generally 10 Times Rating of Primary Fuse	As Intended	Better	None	No Special Method	Very Few
E11	1 Ph. 3 W	95	150	None Used	1–1.5 Amp. Per Kva.	None Used	Successful for over 20 Years	Exceptionally High	None	None — Not Anticipated	None
E12	1 Ph. 3 W	2	2	Min. Load Pt.	2½–5 Times Transf. Rating	50% Rating of Smaller Transf.	Satisfactory	.....	Very Few	None — Not Anticipated	None

(A) Amp. per kva. based on approximately 2,400 volts across transformer. (b) Smaller transformers have larger ratio of fuse rating to transformer rating.

additional set of fuses per transformer (Fig. 5). Here a sectionalizing fuse is provided each way at the transformer pole. A fault to neutral on any secondary section will clear by blowing two fuses only, clearing only the faulted wire. A faulted transformer will clear each side also, but more positive operation results from installing another fuse in the transformer leads. This prevents any service interruption.

Fig. 6, on the above basis, performs like a low voltage underground network except for multiple primary feed. Fuses are applied like limiters. Our original installations a decade ago were equipped with a home-made limiter of No. 2 copper wire with all strands except the center cut out of a 3-in. long section, each end being wrapped and soldered.

Referring again to Fig. 7, an 85-amp. fuse at the transformer will easily clear on all fault currents for the maximum transformer spacing of 1,500 ft. Larger fuses will also clear for shorter spacings. An 85-amp. fuse, however, will carry 150 percent or more of the normal load (splitting two ways at the transformer) of the largest transformer without exceeding its rating. Since it is large enough to carry normal loads, why use a larger fuse?

Fuse Size

A transformer bank system can be laid out to function properly, using only one size of fuse, fitted to the size of secondary and usual spacing employed. It makes no difference whether the bank is a straight line, looped or grid. A grid is preferable, as it gives a larger fault current and more positive, faster clearing. The fuse in the transformer secondary lead should be proportioned to the transformer rating. It need not coordinate with the primary fuse. Its only function is to clear a faulty transformer from the secondary, allowing uninterrupted service to all customers. The primary fuse may be any desired size (as its only function is to clear a faulted transformer on the primary side) consistent with coordination with primary sectionalizing fuses. Any transformer protection from sustained overload is more easily obtained on the secondary side. Suggested fuse ratings for application as secondary lead fuses are: 10 and 15 kva., 100 amp.; 25 kva., 150 amp.

Fig. 8 and 9 show the maximum short-circuit currents which may be obtained from the next adjacent transformer. Second adjacent transformers may be neglected, for practical purposes. A family of curves like these may be set up and prove useful in estimating fault currents on any secondary bank, even a grid type.

Secondary banking has come back and will be increasingly used. Systems started now should be readily extendable, and easy to convert to a 4-wire, 3-phase system by adding one wire without changing the existing type of fuse protection or limiters. A multiple feed secondary network easily follows, with only the addition of extra primary feeds and protectors.

Through the courtesy of the Edison Electric Institute and W. R. Bullard of Ebasco Services, Inc., New York, a table summarizing the fusing experiences of 12 companies operating banked secondaries is included.

• • •

Chart Facilitates Relay Settings

A chart to facilitate the rapid setting of time and current variables on all standard relays was described by G. W. Lee in a recent issue of *Electrical Review*. The chart is readily made by using a standard sheet of 5-in. double log paper and the manufacturer's time current curves.

Using the double log sheet as a master chart, time values from 0.1 to 10 sec. are marked off on the vertical axis and current values from 100 to 10,000 amp. on the horizontal axis. The only moving part required is a protractor (Fig. I) which is made from the manufacturers curves plotted and cut out of cardboard or celluloid for each type of relay; the same can also be done for time-limit fuses.

These respective curves are plotted by means of the master chart as coordinates, the base of the protractor representing the unity time line. The unity current setting is marked off on this edge and other relay current settings are marked off by reversing the protractor on the master chart, placing unity (100 percent) setting on the 1,000-amp. line and marking off against appropriate lines—200 percent, 2,000 amp., 75 percent, 750 amp., etc.

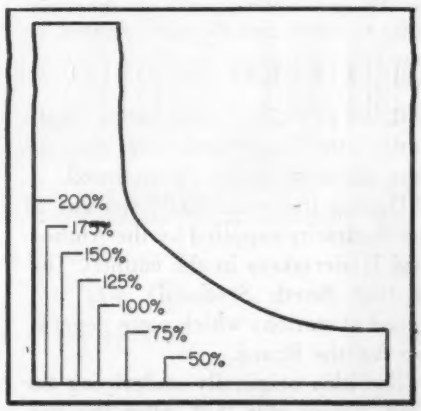


FIG. 1—Typical celluloid protractor

The chart is mounted on a suitable light board and covered with a sheet of tracing paper. The latter is marked at the limits of available fault and earth currents (Fig. 2) and the equivalent supply relay settings (curve 6, Fig. 2) plotted by placing the appropriate curve over the chart with base line against the time setting and the current setting against the current transformer primary full-load amperage (corrected, if necessary, to system voltage). The curve thus drawn records the setting and is used for reference for subsequent settings of other points concerned.

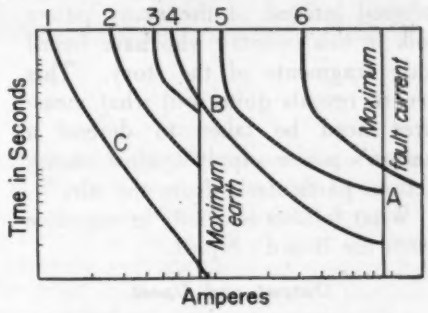


FIG. 2—Representative family of curves on tracing paper derived from master chart; indicates fault, earth currents

Fig. 2 is a representative final result and illustrates at A the use of fault limitation of supply transformers or generators, while at B the necessary modification change from 100 percent to 75 percent of the current setting of relays with dissimilar characteristics to avoid overlapping is clearly shown, and at C the comparison of an overload time limit fuse with the nearest feeder earth fault setting can be seen.

Effect of War on British Grid

All demands met except for local and temporary dislocation—Damage to generating stations, substations, control centers and lines never removed more than 400,000 kw. of capacity against a peak load of 8,351,000 kw.—93.5 percent of system faults cleared correctly

INDICATION of difficulties likely to be encountered in maintaining adequate supplies of electricity during the winter peak periods of the next few years is given in the Annual Report of the Central Electricity Board for 1944. The report contains a comprehensive appendix amplifying the information about the operations of the Grid under war conditions given in the four wartime Reports issued earlier in the year following censorship relaxations. Extracts from the report are presented below to serve the expressed interest of the many power folk in this country who have heard only fragments of the story. This record reveals quite well what measures need be taken to defend a nation's power supply against enemy action, particularly from the air.

What follows is wholly in sequence from the Board's report.

Output and Upset

Total quantity of electricity generated at public supply stations in Great Britain in 1944 was 38,354 million units (provisional). This compares with 36,951 million units in 1943, an increase of 1,403 million units or 3.8 percent. The increase since 1939 has been 11,945 million units, or 45.2 percent of the output in 1939.

Although enemy bombs had on various occasions, since the outbreak of war, severed conductors and damaged towers on the Grid transmission lines, the first occasion on which they totally destroyed one of the steel latticework towers supporting the lines was in February, 1944. Damage caused by escaped barrage balloons, by gunfire and by other military activities was, as in previous years, much greater and more troublesome than damage caused by hostile action.

In March, 1944, the Government released for manufacture 347,000 kw. (subsequently adjusted to 351,500 kw.). The Board, having regard to the position revealed by the load estimates, advanced its completion date to the Autumn of 1946. In July the government released for manufacture a further 1,197,000 kw. (subsequently adjusted to 1,198,700 kw.), being the remainder of the plant which the Board had, in the previous year, put forward as their program for 1947 and 1948.

System Faults

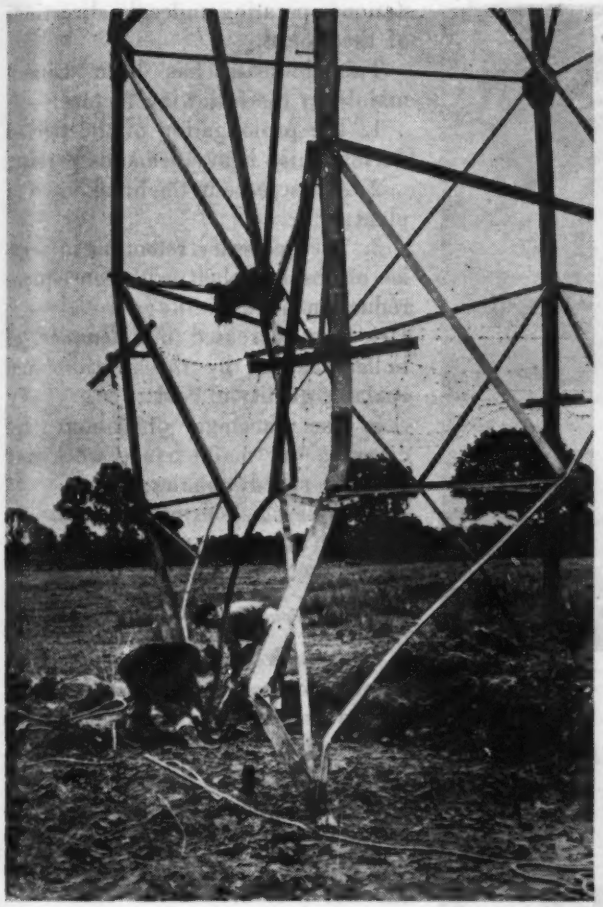
During the year, the number of incidents on the Grid system involving action of the protective gear was 1,134, which compares with a pre-war average of about 400. Despite this great increase, 93.5 percent of these faults were cleared entirely correctly, and the standard of continuity of supply was maintained at a very high level. This is particularly satisfactory in view of the fact that South East England was subjected to renewed bombing from the middle of June until the close of the year. The faults caused by flying bombs and rockets were of a complicated type, involving combinations of short-circuits to earth and between phases, so that the protective gear had to work under conditions much more onerous than those normally encountered.

During the year, 99.03 percent of the electricity supplied by the Authorized Undertakers in the country (excluding North Scotland) was produced at stations which were generating for the Board.

The idea originally underlying the Grid system was that, after the preliminary period of adjustment to existing conditions, the Board should arrange for a sufficiency of plant to be installed in Selected Stations, sited at suitable points, and extend and reinforce the interconnecting Grid in such a way that the demand for electricity could be met with a high degree of economy and reliability. The larger and more efficient stations would, in general, be used for the base load, and the smaller and less efficient stations would be brought into use, as and when required, to meet the peak loads. It was assumed that the growth of demand, whether fast or slow, would be comparatively regular and in accordance with observable trends. There might be and indeed would be, breakdowns and emergencies, but they would be small in number and limited in extent; there would be nothing in the nature of a sudden and universal upheaval. Similarly, it was assumed that the Board would meet with no unusual hindrances in arranging for extensions of the Grid or expansions of plant capacity.

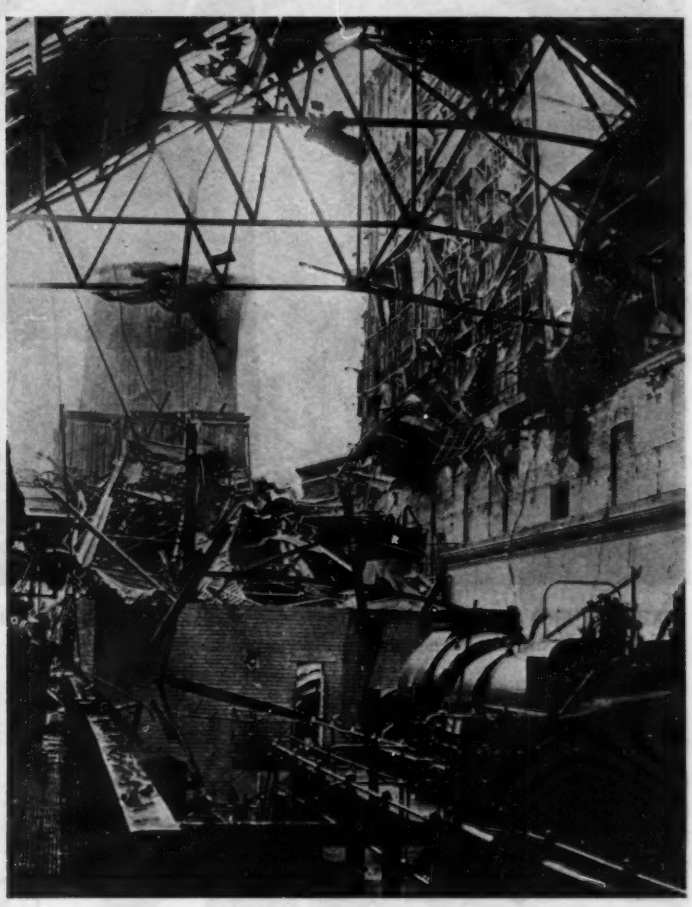
War's Effect

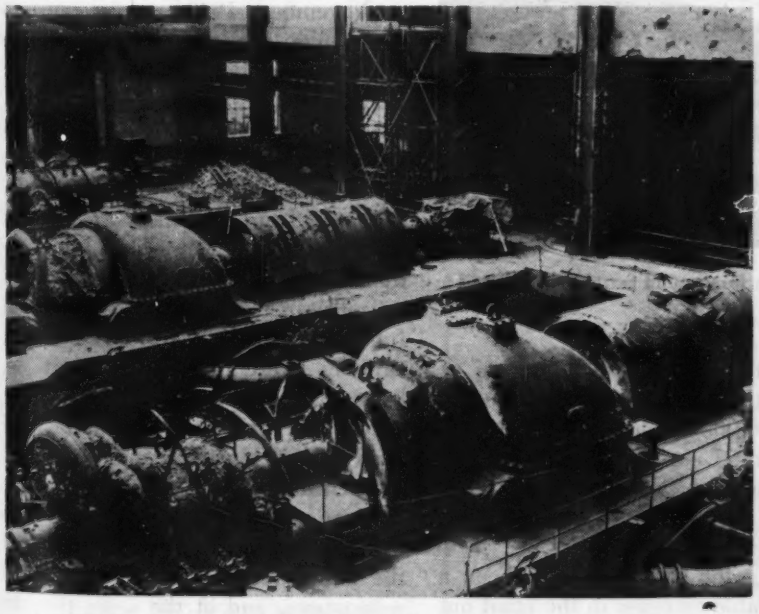
The war cut across this idea and the assumptions on which it was based. The first effect was to produce a sudden and widespread change in the distribution of the load. In certain localities the demands grew so rapidly that the available generating capacity was soon exceeded. Concurrently, the Board had to meet the hazards of war, which were not confined to hostile bombing, but included the effects of many activities in this country, and while the transmission lines and generating stations were exposed to unforeseeable strains and possible disasters, the Board were hampered in the provision of



DURING THE WHOLE WAR PERIOD only one direct bomb hit was made on a transmission tower. All other bomb damage to towers resulted from near misses, typical effect of which is shown in this picture

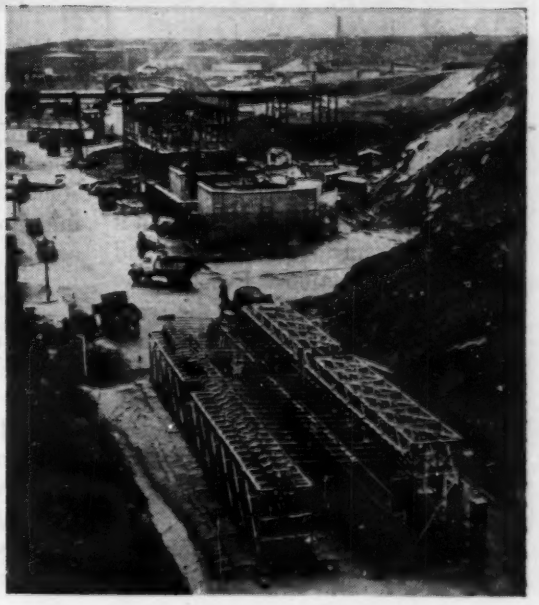
IN 1944 A "DOODLEBUG" struck the boiler room of the Croydon generating station with this result

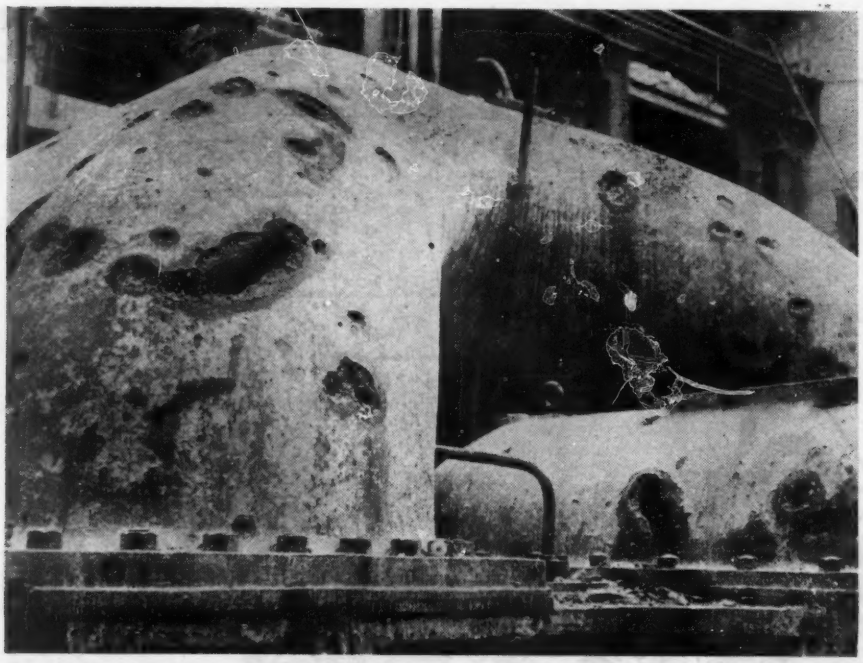




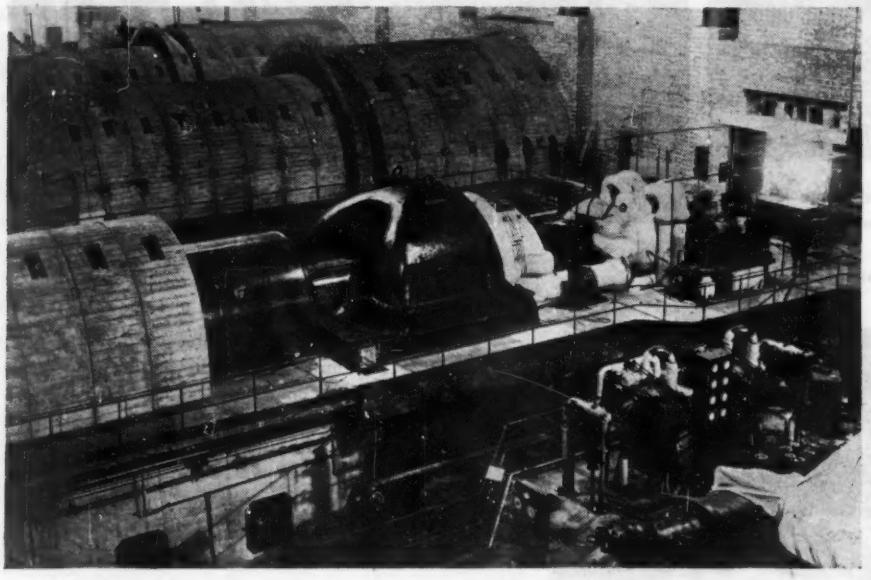
A STRING OF BOMBS walked the length of the turbine room of Fulham generating station in 1940 and knocked out 190,000 kw., the most serious outage of this kind in the war. Local service was quickly restored through Grid system connections

FOURTEEN DAYS AFTER the switching equipment of Plymouth generating station had been knocked out by bombing, this 33-kv. switching structure, built in the middle of a public road with materials and apparatus drawn from the central "pool" stock, was in operation handling the full output of the station. Temporary supply had been provided four days after the bombing





EXHAUST END OF ONE of the Fulham turbines, showing character of bomb damage to machines, all of which was quickly repaired by welding



FULHAM STATION RESTORED to service. Machine in foreground partially protected with semicircular arches of reinforced concrete

new apparatus by lack of materials and shortage of labour. In spite of these hindrances, during the first five years of war all demands made upon it were met, except for purely local and temporary dislocations. Events, however, towards the end of the year proved too strong, when the demands consequent upon a spell of exceptionally cold weather supervened on all the other strains. Twice in November it became necessary to put into operation emergency measures which had already been planned in some detail to avoid widespread interruptions of supply, by shedding in the southern part of the country, for a period of about half an hour on each occasion, some 200,000 kw. of load, representing about 2½ percent of the total load on the system.

Plant Out of Service

During the war, there has been a considerable increase in the plant out of service. In pre-war years, at the time of peak load the percentage of plant out of service was approximately six percent, whereas on the day of maximum demand in 1944 the figure exceeded 18 percent of the aggregate output capacity of all generating stations operating under the directions of the Board.

This increase has been caused mainly by the following factors:—

1. The prolongation of the period during which heavy demands persist;
2. An increase in the breakdown of plant;
3. The necessary retention in service of obsolete plant, with consequent reduction in reliability;
4. The increased maintenance of boilers caused by the inferior and variable quality of coal;
5. The shortage of labour for carrying out maintenance work and effecting speedy repairs; and
6. To a small extent only, the result of damage caused by hostile action.

Transmission Lines

First, and for some time the only, damage to the Grid lines, arising out of the war, was occasioned by the lines being fouled by the anchor cables of escaped barrage balloons. The trouble began in the early days of September, 1939, and has continued with varying intensity throughout the war period.

In the Battle of Britain, damage from bombs and barrage balloons rose to a maximum. So far as the transmission lines were concerned, there were in the four months, August to November, 1940, no fewer than 456 faults due to escaped barrage balloons and 126 caused by bombs. In the single month of September, 1940, the faults from those two causes in the South East England Area exceeded the total number of faults in that area from all causes throughout the whole of 1938. Short interruptions there were, but in spite of all difficulties, the Grid continued to function successfully, and, in general, supplies were maintained. It is, however, becoming increasingly apparent that the lines have been damaged and strained to an extent that is not immediately visible. Directly the war is over, it will be essential to carry out a thorough examination of the lines in order to discover latent weaknesses, and at the same time to put in hand a widespread programme of maintenance and repair.

Control Rooms

The emergency control room in London for the South East England and East England Area was rendered

uninhabitable at an early date, and, though the main control room at Bankside escaped serious injury, most of the adjacent buildings were completely demolished.

It became evident to all concerned that some safer accommodation than existed at Bankside should be found for the Control Staff and equipment. For this purpose two disused lift shafts were leased from the London Passenger Transport Board toward the end of October, 1940, and steps were taken to convert them into control premises. While the conversion was in progress there was a particularly heavy raid on the night of the 29th December, 1940, during which the buildings over the lift shafts were burned out, the contractors' plant on the surface was destroyed, and the bottom of the shafts was flooded by some six feet of water. The work on the shafts, however, was continued, and an emergency control point was established at the bottom of one of the shafts by the end of February, 1941.

Stations and Substations

Damage to the Board's substations was less than had been anticipated and in only a few cases involved any prolonged interruption of supplies. Frequently, when bombs fell in the vicinity, their effect was neutralised by the blast walls, which proved very effective. Where serious damage did occur, it was possible, by means of temporary arrangements, to maintain or restore supplies, pending completion of permanent repairs, although such arrangements involved some added difficulties in operation. As most of the damage was comparatively light, the Board's demands on the National Pool of Spares were infrequent.

Generally speaking, the loss of generating plant caused by air raids was less than had been feared. The most serious incident was the damage to the Fulham Generating Station on the 9th September, 1940, when bombs fell on the engine room and put 190,000 kw. of plant out of service. Fortunately, the Board's substation and the interconnecting transformers and cables were undamaged, and it was therefore possible to resume within a few hours and thereafter to maintain local supplies from the Grid system.

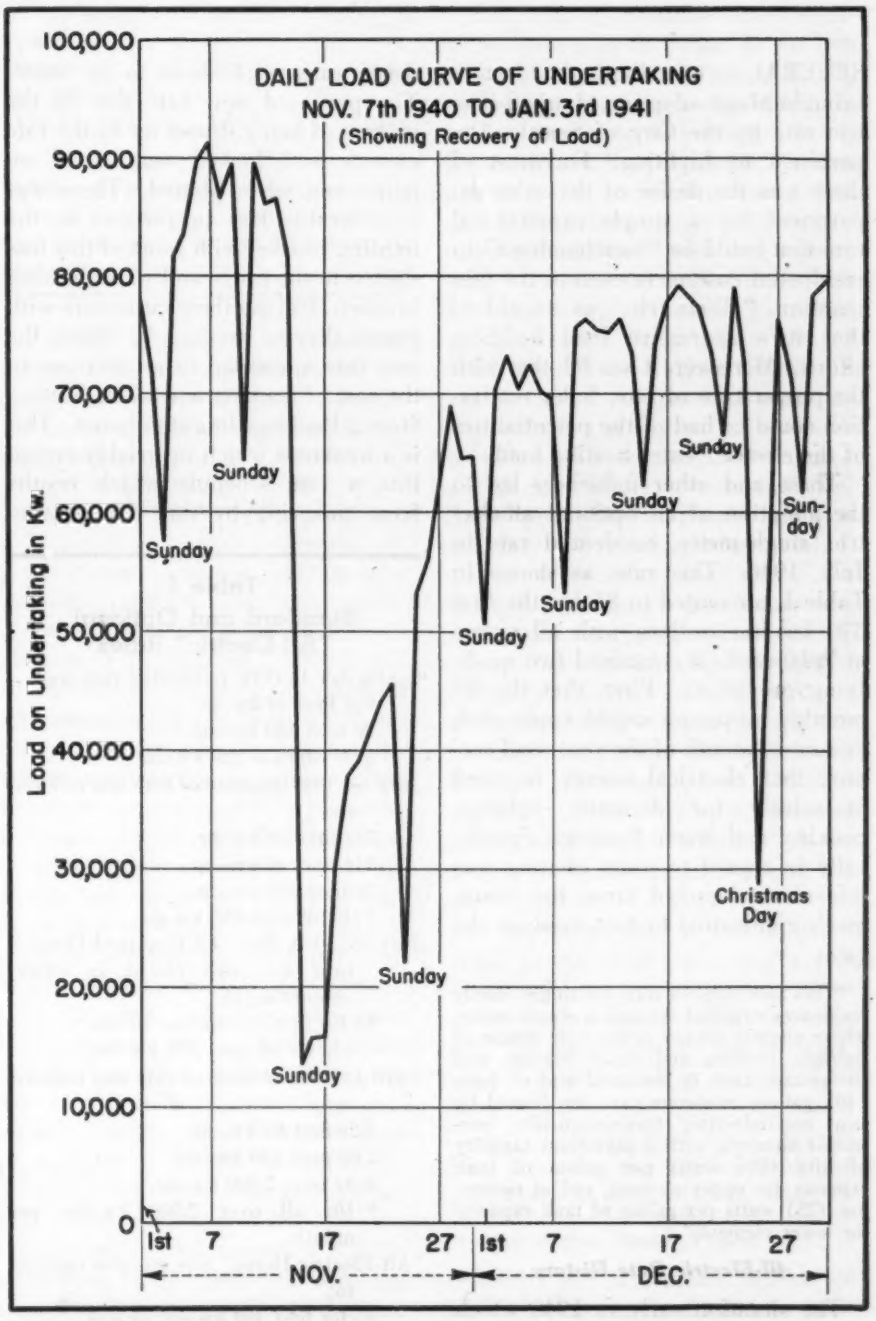
Loss of output capacity due to enemy action has naturally varied, but has never exceeded 400,000 kw. at any one time.

Towers and Conductors

The most serious problem which confronted the Board was that of meeting the changed distribution of load following the establishment of munition works in the west.

At the time when it became necessary to construct the War Grid Reinforcements, the manufacturing resources of the country were already fully employed on the production of munitions, and, in consequence, contracts for the towers and the cadmium copper required for the conductors were, with the concurrence and assistance of the Government, placed in the United States of America.

The consignments, which involved 52 shipments, began to arrive in this country towards the end of 1940 and were completed by the middle of 1941. The U-boat campaign was in progress during the whole of the period, but only two of the ships were sunk, involving the loss of 346 tons of steel towers and 104 tons of cadmium copper. A further 30 tons of steel towers and 100 tons of cadmium copper conductor were destroyed by air raids after they had been landed.



WHAT THE COVENTRY BLITZ did to the electric load. Almost 90 percent recovery in four weeks from a low which was practically half

7,438 Kw.-Hr.—$80 Revenue from Seattle's All-Electric Rate

All-electric promotional rate of 400 kw.-hr. or less for $5 monthly minimum and excess at 7/10 cent proves boon to load building—Also aids in water heater standardization

FRED KNAUS, Industrial Sales Engineer, Department of Lighting, City of Seattle, Wash.

SEVERAL contributing factors brought about adoption of an all-electric rate by the City of Seattle, Department of Lighting. Foremost of these was the desire of the sales department for a simple promotional rate that could be "merchandised" to residential customers even to the designation, "all-electric," as an aid to the city's aggressive load building efforts. Moreover, it was felt that with the proper type of rate, fuller realization could be had of the potentialities of the electric, water heating load.

These and other influences led to the adoption of an optional all-electric, single-meter, residential rate in July, 1940. This rate, as shown in Table I, amounted to $5 for the first 370 kw.-hr., or less, with all excess at 7/10 cent. It contained two qualifying provisions. First, that the $5 monthly minimum would apply each and every month of the year, and second, that electrical energy be used exclusively for domestic lighting, cooking and water heating. Specifically in regard to water heating was this clause, quoted from the customer's application to be served on the rate:

> "This rate applies only to single family residences supplied through a single meter, where electric energy is the only means of lighting, cooking and water heating, and the storage tank is insulated and of forty (40) gallons minimum capacity, heated by two non-inductive, thermostatically controlled elements with a maximum capacity of fifty (50) watts per gallon of tank capacity for upper element, and of twenty-five (25) watts per gallon of tank capacity for lower element."

All-Electric Rate History

The situation early in 1940 which led up to the all-electric rate should prove of interest. A reduction in residence rates was about to be made. The proposed new rate was in the process of being drawn up by the rate experts and looked very good on paper and when plotted. There was considerable loss in revenue in the lighting bracket with some of this loss shifted to the range and water heating brackets, leaving these customers with practically no saving. In effect, the new rate amounted to an increase in the cost of cooking and water heating from a load-building standpoint. This is a weakness which invariably creeps into a rate schedule which results from tinkering by rate experts who have no experience in load building.

Table I
Standard and Optional "All-Electric" Rates

September 1, 1939, residential rate was:
- 4½¢ first 40 kw.-hr.
- 2¢ next 180 kw.-hr.
- 3/4¢ all over 220 kw.-hr.

July 15, 1940, residential rate was reduced to:
- 3½¢ first 50 kw.-hr.
- 2½¢ next 40 kw.-hr.
- 2¢ next 100 kw.-hr.
- 3/4¢ all over 190 kw.-hr.

July 15, 1940, the "All-Electrical-Home" rate was also placed in effect, amounting to:
- $5 for first 370 kw.-hr. or less
- 7/10¢ for all over 370 kw.-hr.

April 1, 1944, residential rate was reduced to:
- 3.2¢ first 60 kw.-hr.
- 2.0¢ next 140 kw.-hr.
- 3/4¢ next 2,300 kw.-hr.
- 9/10¢ all over 2,500 kw.-hr. per month

"All-Electric-Home" rate was also reduced to:
- $5 for first 400 kw.-hr. or less
- 7/10¢ for all over 400 kw.-hr.

An average rate of 1¼ cents per kw.-hr. for lights, cooking and water heating may produce large uses for water heating, yet a straight rate of 1¼ cent would sell few kilowatt-hours for this purpose. Reduced rates, of course, do encourage use, but a major appliance must be added to make the increase felt when revenue again becomes stabilized. To add this appliance, it is not as important whether the ultimate bill is $5, $7.50 or $10, as how much the increase is when the addition is made. All salesmen know what happens over the back fence if a customer is agreeably surprised upon receiving the first bill after adding new equipment. Within certain limits rates should be reduced only when a major appliance is added which supplies 100 percent of the service for which it was installed, thereby raising the customer's value to the utility.

A ¾-cent rate for water heating on a separate meter that had been in effect for sometime was giving customer satisfaction but was fast becoming a nuisance and was not producing the kilowatt-hour sales expected. Considerable expense on both the customer and the city was entailed by the installation of the separate wiring and meter and often separate service as well. The city was spending a lot of money and perpetuating the expense of keeping the account in order to give the customer a lower water heating rate. The rate also had a tendency to emphasize the fact to the customer that about 63 percent of the total kilowatt-hours used went into water heating.

Side-arm type water heaters as an

auxiliary to furnace or range coils were still going in much more frequently than tank units. There was and had been for 20 years a flat rate of $4 per kilowatt-month for water heating. This furnished unsatisfactory service when applied to the intermittent use characteristics of the home and netted a low rate per kilowatt-hour, and in addition was on-peak. Fortunately this service never grew to any proportions and installations have now been reduced to about 250. None of these was considered the answer to the need for an adequate system which would convert all of the potential water heating load to kilowatt-hour sales.

All-Electric Rate

In the sales division, it had been felt for years that a home equipped with an electric range was entitled to a means of heating water which would furnish an adequate supply at all times and at a competitive cost increase. It was also believed that furnace and range coils could be eliminated and a cleancut 100-percent use of electricity for water heating could be obtained if the cost was right.

The time seemed opportune and the all-electric rate was pulled out of the hat as an optional load-building rate and to overcome deficiencies that were apparent in the standard rate (Table 1). Those closest to sales were the most enthusiastic. No opposition to the rate was offered by the engineering division, but the general feeling was that the $5 monthly minimum each and every month of the year without exception would kill the rate. If the rate was accepted the city would be assured a revenue of $60 plus per year. No harm could result as the customer would earn the rate only when the city received the revenue. Perhaps the sales division's contention that sales of tank-unit water heaters would increase might materialize.

By comparison with the city's standard residential rate the all-electric rate is highly competitive with other methods of heating water. The only obstacle in the path to the objective of an all-electric home exclusive of house heating has been removed. The feeling is that saturation will be approached very rapidly in certain areas as greatest usage to date predominates in the humbler and of course in the newer homes. Areas containing 1,300, 900, 500 homes, and many of 200 and 300 homes are entirely all-electric. Some meter reading routes consist almost exclusively of all-electric accounts.

Table II
Acceptance and Results of "All-Electric" Rate

Item	Standard Rate	All-Electric Rate
Av. number consumers.	71,984	16,148
Total kw.-hr. used.....	165,954,843	120,105,602
Total revenue	$3,094,833.57	$1,291,168.91
Av. kw.-hr. per consumer.....	2,305	7,438
Av. revenue per consumer.....	$42.99	$79.96
Av. revenue per kw.-hr.	1.865¢	1.075¢

NOTE: 18 percent of customers constituting all-electric group used 42 percent of total kw.-hr. and provided 29 percent of total residential revenue.

Result of Rate

Of the city's 88,000 residential accounts, approximately 19,000 have automatic tanks of some type. About 17,000 of these were on the all-electric rate at the close of 1944. In addition there are some 3,000 homes in permanent housing projects which are 100 percent all-electric, but for the present are metered on primary and therefore not considered as residence accounts, but are included in a total of about 22,000 automatic tanks supplying hot water for domestic purposes. Kilowatt-hours have increased from an average of 1,492 per residence customer in 1939, to 3,246 in 1944. Revenue has increased from $35.56 average per customer in 1939, to $49.77 in 1944. At the same time two rate reductions have been absorbed. For the year 1944 there were an average of 16,148 customers on the all-electric rate with average annual consumption of 7,438 kw.-hr., and average annual revenue of $79.96. More than 1,500 all-electric accounts were added during 1944, and the year closed with a total of over 17,000.

The new optional rate was about a 20-percent saving for the larger users with less and down to nothing for those with lower consumptions and separate meters for water heating. The change-over of the old tank customers was gradual and at the rate of about 250 a month with about half removing furnace coils. New tank sales were at the rate of about 500 per month, resulting in an immediate increase in revenue. The last six months of 1940 approximately duplicated the previous six years in tank unit sales with considerable increase in kilowatt-hours on old customers due to the removal of coils. Average gain was 1,200 to 1,500 kw.-hr. per year.

Hundreds of customers changed directly from a small 50 kw.-hr. or less per month consumer using lights, wood and coal or gas range with coils for hot water, to a consumer using 400 to600 kw.-hr. per month. Others already using an electric range, but with coils in the furnace, immediately added the automatic tank and permitted the removal of the coils to qualify for the all-electric rate. Some who had been using only side-arms (of which we still have about 15,000) in summer and in conjunction with furnace coils in the winter, junked both the side-arm heater and the furnace coil to get a better service and rate. There were also range sales where a tank only had previously been sold.

Later there were cases where the desire for automatic hot water was responsible for the sale of an electric range. *Dealer sales exceeded those of the city for the first time.* These cases are mentioned merely to emphasize the value of a come-on rate which will eliminate piece-meal sales extending over a period of years, by substituting a rate and a service which gives the customer an inducement to go all the way.

To supply all the hot water for domestic needs alone opens up a tremendous field for load building. That water heating is desirable business from the standpoint of the kilowatt-hour cost delivered as compared to other uses has long been recognized. To sell these kilowatt-hours in volume, however, the service must be satisfactory as well as low in price.

Water Heater Types

One of the unfortunate aspects of the water heating business has been the lack of agreement among operating companies as to type of heater,

wattage and tank size. This has prevented standardization to any great degree and kept costs high. One of the important results of the all-electric rate is the break that it gave to water heating and the opportunity that it has afforded the city in bringing about a high degree of standardization of tank size and wattage.

Seattle City Light has gone through all the throes of the water heating business from the early days of uninsulated tanks and all sizes and types of heaters to the now well developed, highly efficient, factory-built tank heater. Out of a wealth of experience and supported by adequate and reliable engineering data on load characteristics has come a rather definite conclusion as to what is best for both the customer and the city.

Tank Size

The 52-gal. tank with 2,000-watt top element and 1,000-watt lower element at present gives satisfactory service to all but the very highest user group. With the use of this larger tank more work could be given the upper element by lowering it to about ⅓ the way down from the top of the tank, since quick recovery is no longer a necessity. This gives less work for the lower unit and permits the use of a minimum wattage without becoming a flat rate. Temperature controls also enter into this distribution of the work. An attempt is made to set all tanks as nearly as possible to 135 to 140 deg. for the upper end and 145 to 150 deg. for the lower element. Excessively high temperatures quite often cause high bill complaints. There is a definite indication that the demand increases with increase in wattage of the lower element. This demand is further influenced by the probability of the upper element coming in on the peak.

The city's detailed experience with water heating is too long a story to go into in this discussion of the all-electric rate, but well may be the subject of a subsequent article. Suffice it to have indicated the influence of the all-electric rate on the city's water heating policy and the development of this important residential load.

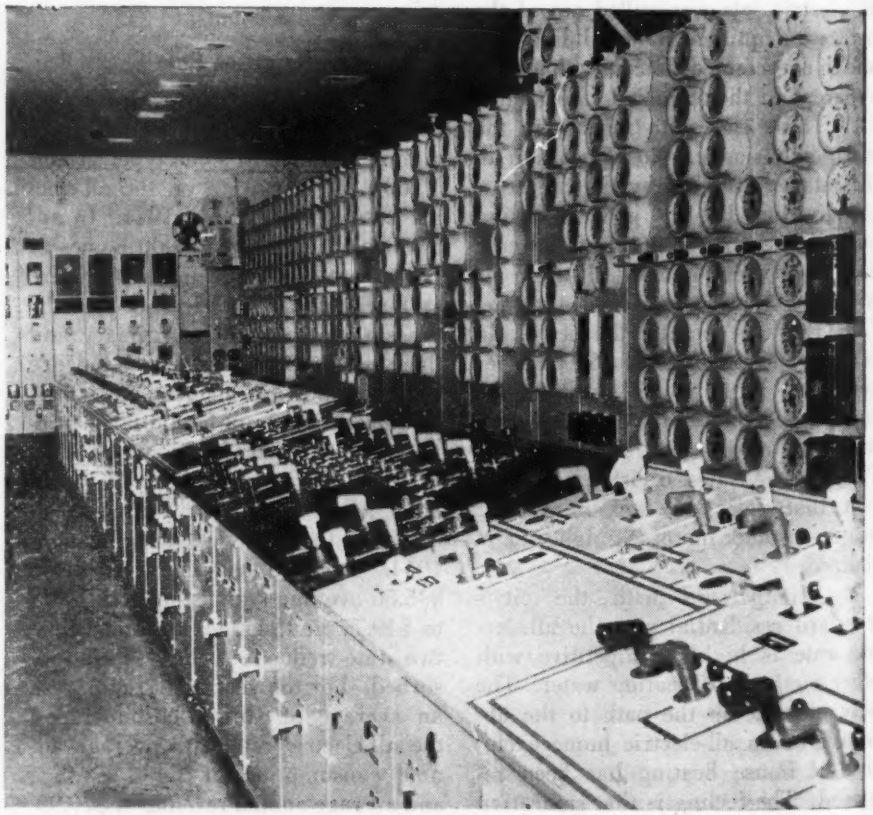
This article does not wish in any way to convey the idea that statements made are applicable to all cases or localities, but merely to present data on what has been experienced in Seattle and which may be of interest to the industry generally, and especially to those who have made studies in domestic load building and rates. The many advantages of an all-electric rate and of the rather remarkable results experienced in Seattle, we believe are quite obvious. The customer feels he is getting more for his money, and actually does, and the city is well pleased with the rapid progress made in load building and with the high yearly return per customer.

• • •

Light Colored Switchboards Banish Substation Gloom

Had it not been for the war, Pacific Gas & Electric Co. would have continued its practice of painting many switchboards in power plants and substations a light color to improve appearance, "seeability" and morale of the operating force. Use of light-colored paint on switchboards had its inception on this system in 1936. After several years experimentation with different colors, letting reaction of operating forces be the determining factor, a standard light-cream color with a slight yellowish cast, was decided upon. Specifically, the paint used is "Opax" lacquer cream No. 101 made by Sherwin-Williams to Pacific Gas & Electric specifications.

Application is by spray gun to vertical switchboards, benchboards and instrument cases. In all instances the entire room is done over at the same time. Where switchboards have been provided with dummy buses, these buses are colored to conform to the company's standard color designations for circuits of the various voltages. Oil circuit-breaker control-handles or knobs are likewise colored, coded, and the ensemble, or overall effect, of the completed job is most pleasing. In fact, this innovation caused such favorable comment by operators, company officials and visitors, that the practice was extended to include generators and turbines in steam power plants. Under war conditions no work of this kind is being done excepting where major additions are under way, such as at Newark substation at the present time.



BLACK MORGUE-LIKE SURROUNDINGS in substations and power plants of Pacific Gas & Electric Co. are being banished by spraying switchboards and instruments a light color. Work here is completed with the exception of one section of the benchboard which depicts the striking contrast between old and new

Handling War-Time Coals in Boiler Plants

Extra preheating of air reduces clogging—Mixing sizes on stokers—Additional soot-blowing installed—Spreader stokers have appeal

IN A LARGE eastern utility generating installation inability to obtain coal of peace-time quality has resulted in many operating problems, both in the handling and the burning of the lower grades of fuel.

War-time coals available show a wide variation in quality and are consistently dirtier, higher in ash and moisture content and lower in B.t.u. value than pre-war coals. Much of the coal purchased is nut and slack which normally ran around 14,400 B.t.u. per pound, 22 percent volatile and 4 to 5 percent ash. The nut and slack now available run around 14,100 B.t.u. per lb., 25 percent volatile and 8 to 12 percent ash. Because of government diversion of the better grades of fuel it is necessary at times to use low grade strip coal containing a high percentage of dirt, slate, moisture and ash. Also straight slack coal containing no lumps and having a high moisture content. In addition to these an attempt has been made to burn relatively high volatile coal, around 36 percent, with a grindability of around 75 percent.

Most of the coal is received by barge or steamer. Many of these vessels were designed for the transportation of general cargo, and because of the location and size of the hatches, the presence of intermediate decks, etc., are unsuited for use as colliers. The unloading costs on some of these vessels are more than double that of the regular colliers due to the greater amount of trimming required and to delay occasioned by the shortage of stevedore labor in the east coast area.

Some of the strip coals that have been used have increased maintenance costs considerably because of the large amount of dirt, ash and over-burden in the coal. This results in increased wear and loss in capacity of the coal pulverizing mills, and serious erosion of induced draft fan parts because of the higher fly ash content of the boiler gases.

Preheating Air at Mills

High moisture content in the available nut and slack and slack coals makes these difficult to convey and handle due to their sticking in the hoppers, chutes and coal feeders. This requires increased labor to keep the coal moving. High moisture content is particularly troublesome in the case of all slack coal. Trouble was experienced in milling the high moisture content coals because of their tendency to stick and clog in the mills. This trouble has been satisfactorily taken care of by preheating the air feed to the mills to a temperature of about 140 deg. F. The air is heated by passing it through steam coils before it enters the mill. Moisture contents up to 10 percent have been handled without difficulty by using preheated air.

In attempting to use high volatile coal in old type underfeed stokers, much difficulty is experienced because of the backing up of gases released at comparatively low temperatures through the stoker coal feed hoppers into the boiler room. This coal is rather lumpy and offers little resistance to gas leakage back through the hoppers.

This same type of lumpy, high volatile coal, with a grindability of about 75 percent, when first used in the coal pulverizing mills reduced their capacity by about 30 percent. The mills are automatically supplied with coal by means of feeders, the speed of which is governed by the air pressure in the mill. It was found that the lumpy coal allowed an excessive amount of air to be drawn into the mill through the feeders with the coal. This, through its effect on the mill air pressure, caused more coal to be fed into the mill than could be taken care of, with consequent plugging and loss of capacity. This difficulty was met by mixing about 50 percent of nut and slack coal with the lumpy coal to lessen the air infiltration through the feeders and by making adjustments to the air pressure and feeder speed ratio.

Boiler efficiencies in the old underfeed stoker section of the station have fallen off from 5 to 10 percent during periods when only slack coal is available, the efficiencies varying with the fineness of the slack and its moisture content. Much of the fine coal sifts into the ash pits and is lost, and a certain amount of the fines are lost up the stack if the coking properties of the coal are poor. Experience indicates that high moisture content impairs the coking quality of the coal.

Boiler Efficiencies

In both the pulverized-coal and stoker-fired boilers, operating efficiency has fallen off due to the high ash content of the fuel, which makes it very difficult to keep the gas passages, tubes and superheaters free from deposits. Additional soot blowing equipment is being installed on some of the larger boilers as it becomes available.

Fusion point of the ash of the present fuels compares favorably with that of pre-war coals and no particular difficulty has been experienced because of slag formation.

The operating staff is giving considerable study as to equipment and methods of operation which would improve present conditions. Considerable interest in the spreader type of stoker, particularly for the smaller capacity boilers, has been manifested because of its ability to operate efficiently with a wide range of coals and hope was expressed that a trial installation might be made. Improved facilities for collecting and depositing fly ash are being investigated as this matter becomes increasingly important with the higher ash coals which it is now necessary to use.

System Application of Phase and Voltage Regulators

Power and reactive transfers around loops and between systems discussed in terms of requisite scope and characteristics of tap-change-under-load equipment for successful correlation with throttle control

A. A. JOHNSON, Westinghouse Electric Corp., East Pittsburgh, Pa.*

TAP CHANGING under load (TCUL) voltage and angle control regulators are now in service on a number of systems primarily to supervise the flow of real or reactive power or both over parallel and loop circuits. Since a regulator can increase or decrease the flow of current over a given circuit it may be looked upon as introducing into the circuit a fictitious impedance which subtracts from or adds to the normal circuit impedance. Actually the regulator introduces into the circuit a voltage which subtracts or adds, by transformer action, at a predetermined phase position to the normal circuit voltage thus causing more or less current to flow in the desired direction.

Regulator Merits

A regulator has many desirable effects such as:

1. Increases or decreases load over a given circuit.
2. Improves voltage levels and circuit power factor.
3. Reduces losses by elimination of circulating currents.
4. Less over-excitation on equipment during light load periods.
5. Balanced loads during emergency as well as normal conditions.
6. Makes possible more economical system operation such as eliminating the necessity of operating a generator for extended periods of time.
7. Defers the construction of a new line or new generating equipment indefinitely.
8. Provides a means of meeting contractual agreements to advantage of all parties as normal growth and load changes occur.

Figure 1 shows a small system connected to a large system through two TCUL regulators. One device has separate phase angle and voltage control and the other has voltage control only. By means of the two voltage controls the voltage on the small system can be maintained at any desired level separate and distinct from the voltage on the large system. This means that the flow of reactive power between the two systems is under constant supervision. The phase angle control is required in one device only to regulate the flow of real power over the two ties. The total interchange of real power between the two systems is entirely a matter of throttle control on the two systems. If the large system is supplying too much power to the small system, with the proper voltage levels and the proper division of real power over the two circuits, then the generators on the small system must advance in angular position by additional throttle opening to reduce the incoming real power. Thus the two TCUL regulators plus throttle gives the small system complete control over the kva. on the two ties thereby enabling contractual agreements to be maintained.

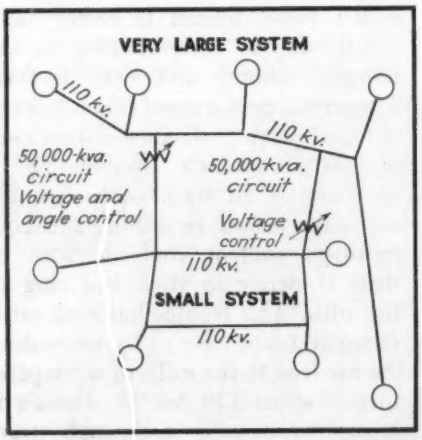


FIG. 1—Separate phase angle and voltage TCUL regulators between a small system and a large system

Long Loop Flow

Figure 2 is an application for a large phase-angle regulator to control the power flow in one section of a long loop. It is desired to send a maximum of about 17,500 kw. at 80 percent power factor from generating station A to station B. Due to the maximum power flow around the loop from A to F to E to D to C to B, the A bus leads B bus by a maximum of 40.5 deg. For the power flow indicated the circuit from A directly to B requires an angle of 1.2 deg. This means that a TCUL angle regulator must be applied in the A to B circuit and for the conditions shown must have its output voltage lagging the input voltage (A bus) by 39.3 deg. Due to the fact that the load from A to B will at times be less than the specified maximum and also because the loadings on the various sections of the loop will vary, the regulator must be capable of working over a range of from zero degrees to about 40 degrees.

In order to control the power flow over circuit A to B without a regulator one generator at station A must be isolated from the bus and connected directly to this line. This type of operation is undesirable because a 32,000-kva. generator must be tied up to supply a load which varies

*Central Station Engineer.

from about 10,000 to 22,000 kva. The values on the diagram in the parenthesis are percent impedance and the other values are percent current.

Heavy Load System

Figure 3 is a simplified form of an elaborate and heavily loaded system. Generating stations A and E have large generators and heavy city loads. The bus B is fed by one new generator and several tie lines from bus C. In order to give reliable service to B, and at the same time shut down the generator at B, which for about ¾ of the year was not needed, it was found economical to install a new tie feeder from A to B and provide in this tie the necessary TCUL angle and voltage control. The tie feeder is 13.8 kv. and required a regulator having ± 10 percent voltage control and separate angle of ± 12.5 deg. The vector diagram at the bottom of the figure shows voltage conditions at A and B. The solid line E_B is the voltage at B. The voltage E_A at bus A may have the same magnitude as E_B, since both are shown as 13.8 kv., but it may terminate at any point on curved line XY within the angle range of ± θ which is ± 12.5 deg. If we assume that E_B is constant at all times then the TCUL voltage and phase angle control can insert a voltage and angle into the circuit so that in effect the voltage at bus A, neglecting drop due to load in the feeder, can terminate at any point in the area 1235. Actually the voltages at buses A and B will vary about ± 5 percent which is covered in the ± 10 percent available in the regulator. The angle between buses A and B also varies because of the varying amounts of power transmitted over other circuits forming a loop with the one being discussed.

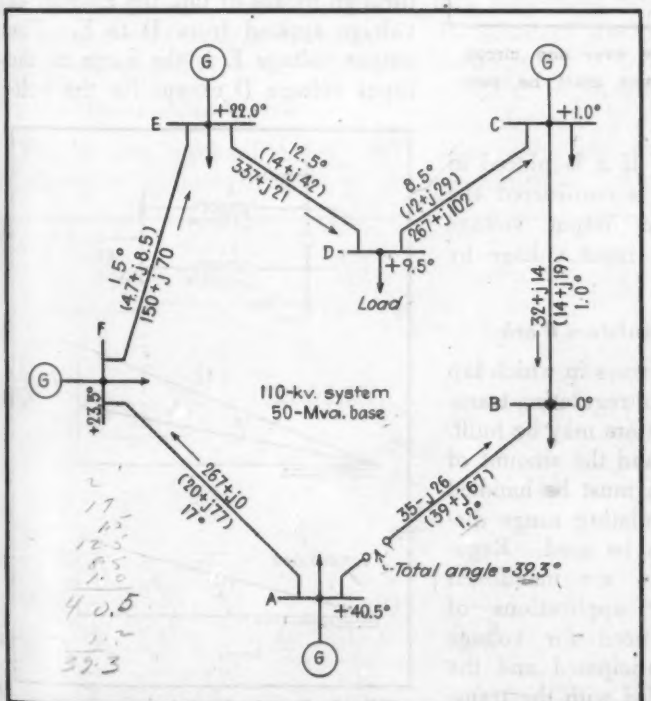
Why Angle and Voltage Differences?

Whenever an a.c. current flows through a circuit there is a voltage drop which may or may not be in phase with the voltage depending upon the power factor of the current and the circuit impedance. The current in a circuit may be broken into the "in phase" and "out of phase" parts and each part applied separately first to the circuit resistance and then to the circuit reactance. Figure 4 shows several vector diagrams for a sending end voltage E_S and a receiving voltage E_R with a current flowing to the receiver end. Figure 4a shows a current in phase with E_R flowing through a resistance R with the voltage drop, I_1R, in phase with E_R. Figure 4b shows the same current flowing through a reactance X and the voltage drop I_1X is leading E_R by 90 deg. In Figure 4c the current is lagging E_R by 90 deg., flows through the resistance R, causing an I_2R drop which lags E_R by 90 deg. Figure 4d completes the picture and shows that the lagging current, I_2, through the reactance X causes a voltage drop I_2X in phase with E_R. The lower part, Figure 4e, is a composite vector diagram of the four parts above it.

When the various voltage drops are combined due to the total current $I_1 + I_2$ there is a voltage and angle difference between the receiving and sending end voltages. In an actual system both voltage and angle differences take place between various points in varying amounts as the system load changes. Where there are parallel circuits, loop circuits and cross-connected circuits, a loop circuit within a loop circuit, etc., the problem of determining the required degree of control is difficult. This problem, even though complicated, can be solved on an a.c. network calculator. By applying voltage and angle tap changing under load regulators, the real and reactive power flow can be controlled. In most applications angle control only or voltage control only offers a practical solution.

Single Tie

Figure 5 shows a large system supplying power, through a single tie



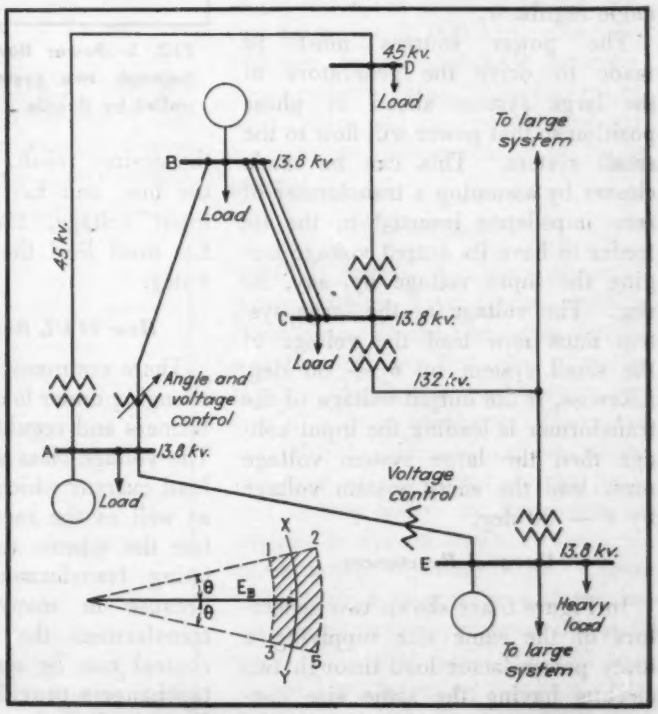


FIG. 2 (left)—Indicated need for 39.3 degree TCUL angle regulator in a long loop. Values in parenthesis are percent impedance and other values are percent current. FIG. 3 (right)—TCUL regulator with separate angle and voltage control circuit between stations A and B. Regulator has voltage control of ± 10 percent and separate angle of ± 12.5 degrees

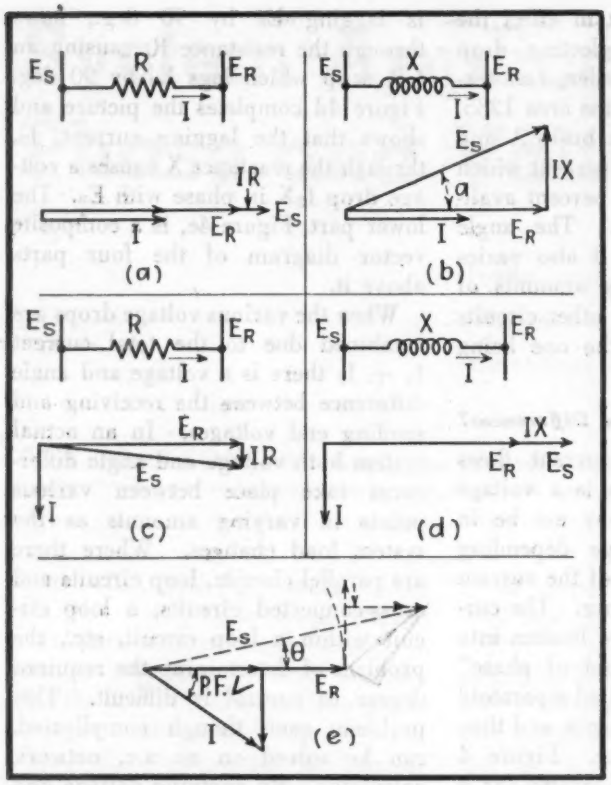


FIG. 4—Fundamental relations between R, X and I which cause angle and voltage differences between circuit sending and receiving voltages

feeder having an impedance of Z, to a small system. To do this the voltage of the large system must lead in phase position by θ deg. the voltage of the small system. This must be done by throttle control on both systems; it cannot be done by an angle regulator.

The power sources must be made to drive the generators of the large system ahead in phase position so that power will flow to the small system. This can be made clearer by assuming a transformer of zero impedance inserted in the tie feeder to have its output voltage lagging the input voltage by, say, 30 deg. The voltage of the large system must now lead the voltage of the small system by $\theta + 30$ deg. Likewise, if the output voltage of the transformer is leading the input voltage then the large system voltage must lead the small system voltage by $\theta - 30$ deg.

Unequal Reactances

In Figure 6 are shown two generators of the same size supplying a unity power factor load through two circuits having the same size conductors but one circuit has twice the reactance of the other. For each generator to supply 50 percent of the load, with the bus breaker open, the angle θ must exist between the generator voltages E_{G1} and E_{G2}. If the generator bus breaker is closed, then the circuit having the lower reactance will carry $\frac{2}{3}$ of the current. Thus, to operate with the bus closed, a phase angle regulator must be placed in the bus or in one of the circuits to make each circuit carry 50 percent of the current and it must have an angle control range of θ deg. If the regulator is placed in the circuit with the lower reactance its output voltage must lag the input by θ deg., in order to accomplish

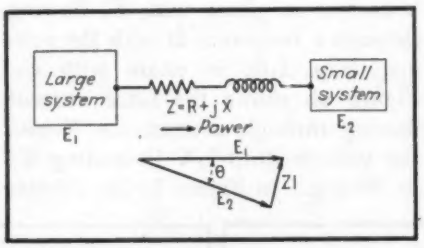


FIG. 5—Power flow over one circuit between two systems must be controlled by throttle.

the desired result. If it is placed in the bus, and E_{G1} is considered the input voltage, the output voltage E_{G2} must lead the input voltage by θ deg.

How TCUL Regulators Work

There are many ways in which tap changing under load regulating transformers and regulators may be built. The voltage class and the amount of load current which must be handled as well as the regulating range dictate the scheme to be used. Regulating transformers are mentioned because in many applications of transformers the need for voltage control can be anticipated and the tapchangers provided with the transformer, all designed as one unit.

The basic schemes used for building TCUL regulators are shown in Figure 7. Figure 7a shows "in phase" voltage control where the output voltage may be larger or smaller than the input voltage. Figure 7b shows the arrangements for obtaining angle control up to about ± 15 deg. The diagram shows the output voltage leading the input voltage by an angle θ. By reversing the connection of the out of phase voltage component the output voltage can lag the input voltage by an angle θ. The value of 15 deg. as the usual maximum range for this type of device is because the output voltage gets to be too large if larger angles are obtained by these connections.

Figure 7c is an arrangement whereby fixed amounts of voltage and angle are obtained with one tap changer. The voltage added to phase A, is obtained from the core of phase B, etc. This type of regulator is good for pushing real and reactive power in one direction over a circuit but is not very effective for reactive power in the other direction.

Large Angle Regulation

Figure 7d is the scheme used for obtaining large angle regulation up to ± 60 deg. The voltage DE is obtained from the exciting winding CB and shifts the line-to-neutral voltage from D to E thus giving an angle θ. The angle is varied by changing, through means of tap, the amount of voltage applied from D to E. The output voltage E is the same as the input voltage D except for the volt-

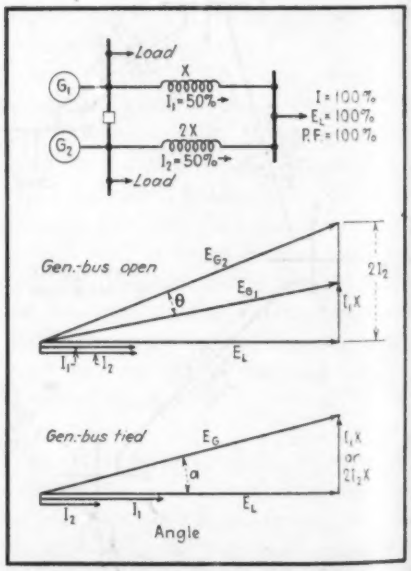


FIG. 6—Required control angle θ to make two parallel circuits of same size but unequal reactance carry same load current; load is at 1.0 power factor

age drop in the regulating windings. The excitation voltage A to neutral varies from normal system line to neutral voltage to 86.6 percent of normal line to neutral voltage for a regulator having a range of ± 60 deg. In the sketch shown the output voltage lags the input voltage by 60 deg. By reversing the voltage DE the output voltage can be made to lead the input voltage by 60 deg. Compensation for the voltage drop in the regulator windings for a certain load can be accomplished by making the voltage AE larger than the voltage DA for one direction of current flow.

Composite Device

Figure 7e provides connections for obtaining separate phase angle and voltage tap changing under load in the same device. The exciting winding is connected in delta, the voltage control winding in wye and angle control is single phase with excitation from the proper winding. The in phase or voltage control is obtained from the wye winding by tapping two phases; the voltage DA is the voltage in phase with the normal line to neutral voltage AN. The angle control is obtained by adding the voltage DE to the voltage DN. Voltages AD and DE are varied separately by changing the tap positions on the two auxiliary windings. Thus, the input voltage to the regulator is AN and the output voltage is EN.

Breaker Mechanism

The breaker mechanism used for tap-changing under load is shown in Fig. 8. For operation at the full boost position contacts No. 1 and switches A and C are closed. This means that the preventive auto-transformer is shorted and affects the circuit only to the extent of the resistance of the two windings in parallel. The flux in the core of the preventive auto is zero for this connection.

The reason for using a "preventive auto-transformer" is to prevent short-circuiting turns on the transformer winding during tap-changing operations. The actual tap-changing is done by switches A, B, and C while the contacts 1 to 9 merely select the required transformer tap to which the load is transferred. In order to change from tap 1 to tap 2, close contact 2, open switch C, close switch B, open switch A, close switch C, and open contact 1. This process is repeated for each change from one tap position to another.

Control Range

In applying TCUL regulators in loops or parallel circuits the circuit having the least through kva. rating should be selected as this will give the least kva. parts in the device. Also a circuit location should be selected, as far as possible, where the short circuit kva. which the regulator windings may have to handle is within the standard design of transformer windings.

TCUL regulators are basically static devices. They respond to time delay automatic or manual control mechanisms. These equipments, therefore, cannot change taps in time to be of any benefit in stability problems. The fact that a voltage regulator may be boosting at the time of a system disturbance may, however, be a big factor in maintaining system stability.

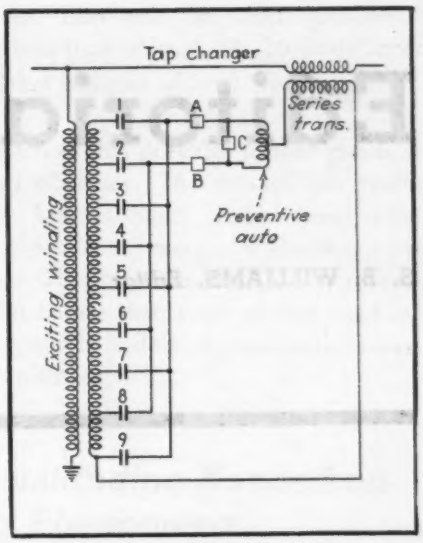


FIG. 8—Tap changer for one phase of a large voltage regulator

The usual range of control is in the order of ± 7.5 to ± 15 deg. for angle regulators and ± 10 to ± 20 percent for voltage regulators. Units have been built for use in circuits having emergency ratings up to 60,000 kva. Only one unit is in service at a voltage above 115 kv. and it is for 132 kv. at a normal circuit rating of 25,000 kva. with 33,333 kva. forced cooled. It normally operates for separate angle control of ± 12 deg. and can be reconnected for separate voltage control of ± 20 percent.

System Studies

TCUL devices for large or small power systems have a very definite place in the design and expansion of a system. Only a few miles of transmission circuit can be built for the cost of a large regulator. There are undoubtedly many situations where this type of equipment can be justified economically on the basis of savings in system losses or deferred construction or both. As system loads further increase and tie feeder reserve capacities are used up, it is very likely that TCUL devices will be used in increasing numbers. System studies, both analytically and on the a.c. network calculator will show the advantages and merits of these devices.

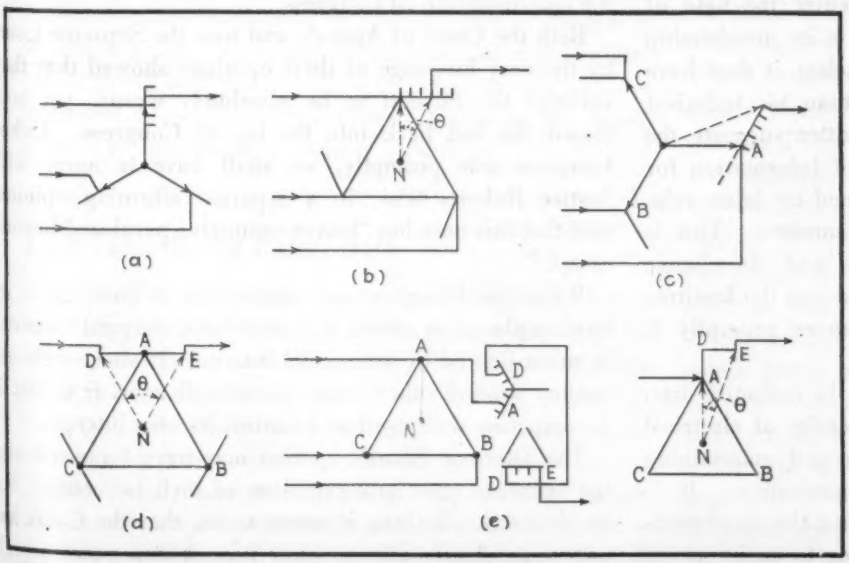


FIG. 7—Fundamental transformer vector diagrams for TCUL voltage and angle regulators (c) is for angle control up to ± 15 deg., (d) for ± 60 deg.

Editorials

S. B. WILLIAMS, *Editor*

AIEE Report on Collective Bargaining

THE AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS will continue to be interested in labor relations problems of engineers, but it will not become a collective bargaining agency nor will it assist in the creation of unions for engineers if the recommendations in the report of the special committee appointed a year and a half ago to study this matter are accepted.

When this problem of unionization of engineers first came up through the organizational efforts of the American Society of Civil Engineers we took the position that it was a serious problem and not one to be decided by personal opinion, but only by the engineering approach of first getting the facts. It is apparent from the report of the committee that this is exactly the procedure followed, with the result that the Institute is provided with a set of recommendations carefully drawn up and giving one the impression that the committee was fully sympathetic to all phases of the problem and were eager to be of constructive assistance.

That the Institute itself could not enter the field of labor organization is obvious, having in its membership both employee and employer. Nevertheless, it does have some interest in the engineer other than his technical progress. For that reason the committee suggests the Institute not only prepare a manual of information for members but that it keep itself informed on labor relations matters through a continuing committee. This is sound policy because conditions can and do change quickly in the collective bargaining field and the Institute should be in a position to meet changes promptly if necessary.

The interest the Institute has taken in collective bargaining is further evidence of the necessity of electrical engineers, wherever located, acquiring and maintaining membership in their professional organization. It is obvious that the Institute, by thus serving the non-technical needs of its members, is contributing to an improved professional status for the whole group.

Repeated emphasis is perceived in the report on the advisability of conducting collective bargaining through professional employee groups rather than groups predominately composed of non-professional employees. The advantage there lies more in the fact that the engineers would be more likely to have bargaining units of their own choosing.

It is unfortunate that the report will not have the advantage of an open hearing with free discussion although the work is so well done we would not expect much, if any, contrary expression. Discussion, however, is requested and it is hoped that anyone who has any views will communicate with the committee. This will afford one way at least of gaging interest.

New York Boycott Strengthened by Supreme Court Decision

AFTER A DECADE of litigation and some 25,000 pages of evidence in the New York City Chinese Wall case involving the boycotting by Local No. 3, IBEW, of all electrical materials not made locally by its own members, a decision has been handed down by the Supreme Court of the United States that while saying differently, in effect gives legal sanction to unions to prevent the importation of goods into any large city.

Last fall the Circuit Court of Appeals upheld the boycott until such time as preventive legislation was passed. Now the Supreme Court reverses that decision to the extent of holding that the union was acting illegally when it acted in agreement with non-labor organizations, the employers. On the other hand, the union can effect the same results legally, provided it acts alone and makes separate contracts with each employer. "This, it is argued," says the opinion, "brings about a wholly undesirable result—one which leaves labor unions free to engage in conduct which restrains trade. But the desirability of such an exemption of labor unions is a question for the determination of Congress."

Both the Court of Appeals and now the Supreme Court by the very language of their opinions showed that they believed the boycott to be absolutely wrong, yet both tossed the ball back into the lap of Congress. Unless Congress acts promptly, we shall have to agree with Justice Roberts who, in a separate affirming opinion, said that this decision "leaves commerce paralyzed beyond escape."

Whenever labor, or any other class, is freed from restraints placed on others, it is found that the public interest is subordinated to the special interest. If such walls are erected around other cities, labor will soon find that it is competing with itself and against its own interest.

The Supreme Court's opinion may have some restraining influence upon any extension of such boycotting, but we doubt it. In fact, it seems to us, that the Court has now very clearly shown labor how it can erect a wall with impunity.

ASA Now Free to Enter Consumer Goods Field

ANNOUNCEMENT was made this week by American Standards Association that it can now handle standardization projects in the field of consumer goods. As a matter of fact, ASA has been engaged in a limited way in consumers' goods standardization for several years, but principally in products that could comply with the restriction limiting the work of ASA "to those fields in which engineering methods apply." Standards for several classes of residential electrical appliances, for instance, were worked on.

Now, however, ASA has broken all bonds that tied it down to engineering projects and it may engage in any field which deserves national recognition.

This is a real tribute, not only to ASA but to free enterprise in this country. For some time strenuous efforts were made to center all consumer standards work in the Bureau of Standards. It has always seemed to us that government bureaus should restrict their work to tasks that required enforcement while performance standards should be the result of understanding between those who make and those who use. That means, of course, that all with an interest should have a voice and that has been basic with ASA from the beginning.

Performance standards for consumer products have been greatly needed and after the war with all of the new materials and substitutes available it is evident that the consumer will need unbiased guidance. As in the field of lighting, there will be a growing demand for certification. It would appear from ASA literature that it is not planning itself to certify products but it did a year ago set up a proposed standard practice for certification procedures. This would lead us to believe that with heightened interest in the consumer field we might expect certification and labelling of products meeting ASA standards of performance.

It is hoped that this will not be long in coming so that performance standards can be taken out of the hands of radical groups, or organizations that can make capital out of them, and placed out in the open for all who are interested to see how they operate. This is the democratic way because it is entirely voluntary.

The Growing Fuel Bill

IT IS INTERESTING to note in the annual reports now being received for 1944 operations how many of them draw special attention to the growing fuel bill. Part of this it is explained is due, of course, to increased output but considerable is due to increased price, power cost and the necessity for using older and less efficient plant.

They might also have pointed out that the recent increase in the cost of bituminous coal to cover the wage increase for miners, 16 cents of which was permitted to be passed on to the consumer, will add just so much more to the operating costs. Last year the electric utilities consumed 82.76 million tons of coal. At 16 cents increase the increase on that amount of coal would be over 13 million dollars.

Any increase such as this provides further justification for improved fuel efficiency. The average last year was 1.33 lb. of coal per kilowatt-hour. Modern highly efficient generating plant is producing energy for less than a pound per kilowatt-hour. This plus the need for more reserve of a more efficient nature than some of that used in the past two or three years is finding expression in orders for additional steam plant capacity.

More Understanding Needed on Grounding Phenomena

THERE IS NOTHING as sure in the realm of electrical potential as the certainty that earth potential is basically zero—in fact, it is the only datum we have. Grounding as a practice is based on that fact but the built-up technique of grounding is not quite that simple. On the contrary there is a growing disposition to hold to opposite philosophies founded on the same rudimentary idea.

There have been those who were set against grounding distribution transformer tanks; they argued greater hazard in the event of accidental contact simultaneously with an energized conductor; they argued greater insulation strain, etc. The other camp is finding equally potent arguments in favor of grounding the tanks. In the field of safety grounding of temporary nature for maintenance and inspection work there are corresponding divergencies. Some insist there is more risk of misadventure on the whole in making the protective ground than there is when equal assurance can be afforded that the line or equipment will continue de-energized while the work is being done.

The real point is that the whole art of grounding deserves being given study simultaneously in all its ramifications because it underlies so many of the apparatus standards and practice codes.

Consequences of grounding are so ramified that benefits would be undoubtedly large if the whole art were elucidated, clarified and coordinated over the whole gamut of voltages from 110 to 220,000. Safety to man and beast and buildings, simplification of the relaying and fusing art, readier standardization of the insulation provided, uniformity in operating practices, uniformity in design of equipment destined to have protective grounds applied—all these would be potential benefits. Others might be in the direction of eliminating some of the present requirements and practices as unnecessarily burdensome.

If there ever was a call for a book devoted solely to a branch of electric science it is in the area of grounding. It needs to be comprehensive, from kindergarten to Ph.D. in scope. With that available there could be real progress in dispelling the fogs surrounding grounding and bringing discordant practice into line with the clarified principles.

WASHINGTON COMMENT

By R. N. LARKIN, Washington Correspondent

Krug Mentioned as Ickes' Successor

THE RECENT resignation of Frances Perkins as Secretary of Labor leaves Harold L. Ickes, Secretary of the Interior, the last remaining member of the cabinet which took office with Franklin Roosevelt somewhat more than twelve years ago. It appears to be a fact that Ickes' resignation will be accepted reasonably soon.

Ickes was one of those cabinet members said to be slated to go when the first concrete administrative plans of the Truman Administration were disclosed by government men in a position to know them, shortly after the death of President Roosevelt. Thus far, only he and Treasury Secretary Morgenthau remain in office of the cabinet members then cited as on the way out.

Power Industry Interest

Ickes' departure, when and if it occurs, will be of considerable moment to the electric power industry with which Ickes has been competing since he took office.

Of equal moment to the industry will be the successor to Mr. Ickes. Among those mentioned for the job is WPB Chairman J. A. Krug.

As far as Krug is concerned, it is reported by people who have every opportunity to know the facts that responsible administration people have broached to him the possibility of his accession to the Interior job. It is the feeling of some Washingtonians who know Krug well that he would take the job if it were offered, and many feel that Mr. Truman could do a good deal worse than Krug when he chooses the next Interior secretary.

The job requires a man of considerable administrative capacity. Krug has that, as he has demonstrated in his steady rise from the head of a one-man OPM office to chairmanship of about the only agency in Washington whose jurisdiction is as widespread as that now held by Ickes. The job also requires considerable ability at the catch-as-catch-can, political in-fighting in which cabinet members engage for reasons which are not always clear or important. Ickes has demonstrated himself a master of this, a fact witnessed by his present jurisdiction, which is notably larger than it was in 1933. Krug has enough of this ability to have gone steadily upward in power and prestige during the war, and on the way, he became one of the relatively few government officials to have won a decisive victory over Ickes. This came when he thwarted one of Ickes' fondest dreams, that of becoming overall war energy Czar. Ickes got coal and oil, but he never managed to take over electric power, and one reason he failed to get it was that Krug outmaneuvered him. The fact is that Krug was invariably right and has so demonstrated every time Ickes and/or Leland Olds went crying to the White House with tales of discrimination against public ownership or warnings of a power shortage.

Politically Short

A third prerequisite of the job is political acceptability, and on this score, few can see much reason why Krug would appeal to a President as party-minded as Mr. Truman. This is not to say that a man needs to have 23 wards of a large city in his hip pocket to get a job in the Truman Administration; but it is apparent that such Truman substitutions as Clarke for Biddle, Anderson for Wickard and Schwellenbach for Perkins have more political weight than Krug could muster with a crane. Nor has Krug the personal fortune which would enable him, if necessary, to pay his political freight. About the only political qualifications Krug possesses are his outstanding record of public service and his lack of political enemies. These might not be inconsiderable in view of Truman's insistence that an appointee, however political, have something on the ball, and in view of the requirement that the Senate confirm Cabinet appointees.

Since the Interior Department under Ickes has become a major producer of electric power—a producer whose properties are somewhat less integrated than would be required by section 11 (B) (1) of the Holding Company Act if the properties were under private management—Krug's appointment to succeed Ickes would not be inopportune so far as Interior's power business is concerned.

No Down The Middle Policy

As the man who laid out a major portion of the nation's war power policy, Krug played the public-private ownership fight straight down the middle. A few decisions were made at the White House, and each side points to scattered instances of what it calls favoritism. Actually, neither side can complain of anything more serious than that the other side got a fair shake.

If Krug were to become Secretary of the Interior, the privately owned portion of the electric power industry should not look for a continuation of this policy. Krug always has been basically a public power man. Even if he were not, he would operate, in Interior, not under the broad, inexact powers of a war agency but under carefully spelled-out Congressional policy, which has, whether properly or improperly, consciously favored and promoted public ownership. Under such circumstances, Krug would be doing less than his job if, as Interior Secretary, he continued to play it down the middle.

The most that private power could expect of Krug as Interior Secretary would be a change from the Ickes' proposition that private power exists only to be wiped out to the proposition that public and private power are both here in fact, that both are in business to stay, and that the public interest would best be served by the working out of some means whereby each can live equitably with the other.

NEWS OF THE WEEK

Administration's Post-War Plans Revealed by Vinson

WMC Director Fred Vinson in Report to Congress Lists 9 Points on which Action Will Have to Be Taken after V-J Day to Raise American Standard of Living—Low Taxes, High Wages, More Work are Theme

The Truman Administration's post-war program—aimed simultaneously at a better nation to live in and a second term—was unveiled this week by War Mobilization Director Fred Vinson in the third report of his office to Congress.

Vinson lists nine points on which action will have to be taken after V-J Day to build "a post-war economic charter for a steadily rising American standard of living." They are:

Taxation, which must be modernized to afford high employment and production.

Small business, which must have a program to foster and encourage its expansion.

Competition, which must be encouraged as a "keystone to our free society."

Labor, management and wages, which must be aided by measures to lessen industrial strife, broaden minimum wage protection and encourage a high-wage policy.

Foreign trade, which must be encouraged by the destruction of artificial barriers.

Social security, which must be broadened in the forms of unemployment compensation, old age pensions and health and educational programs.

Farming, whose standards will have to be raised to correspond to those of the rest of the nation.

Public works and construction, where a long-term program of public works and the encouragement of a "far greater volume of private construction for housing than we have ever had in the past" must be sought.

Fiscal policy, which must be aimed at coordinating all government programs whose effects are either inflationary or deflationary and at maintaining the economy at or near full employment.

Overhaul of the tax system, Vinson declared, is "the foundation of our entire program to reach and maintain full employment." It is anticipated that the personal income tax, with a broad base, will be the backbone of the system with sales and excise taxes minimized. Excess profits tax should be repealed promptly after V-J Day and business taxes then modified, keeping in mind revenue needs and the incentive for risk-taking and business expansion.

Competition must be achieved not only by vigorous enforcement of the anti-trust laws but by "a positive program" including an overhaul of the patent system.

With regard to labor, Vinson asserted that "American business is coming to realize that a high wage policy is in the long-run to the interest of everyone." Arbitration should be substituted for strikes but not to the extent of compulsory arbitration.

Praising the recent Congressional action toward freeing inter-nation movement of goods and capital by extending the reciprocal trade program and the Bretton Woods international bank, Vinson declared that these must be continued and that the Export-Import Bank should be expanded and that legislation forbidding loans to defaulting nations be repealed.

Social Security should be considered not only from the humanitarian point of view but as a protection for mass purchasing power, Vinson said.

In the construction field, Vinson urged the construction of 1,250,000 new, non-farm dwellings a year, higher by one-third than the best year on record. Post-war construction should reach about $15,000,000,000 annually. The construction industry, Vinson went on, has lagged behind American business as a whole in technological advances and in progressively reducing the cost of its product. It should be scrutinized with the aim of cleaning up restrictive practices in materials, labor and financing.

The post-war federal budget, Vinson expects to run about $25,000,000,000 a year and calls for a consistent fiscal policy which considers the economic effects of each tax and expenditure. Vinson endorsed the Murray "full employment" bill as a means of approaching this problem.

•

Scheduling Dropped on Electrical Items

Another step in the Office of War Utilities "decontrol" policy was taken this week when six items were removed completely from scheduling controls of order M-293 and all but three other electrical items were reclassified so as to eliminate the requirement of monthly reports on shipping schedules.

In addition, OWU amended Schedule IV of order L-154 to remove from specifications control all power switchgear except metal clad switchgear and oil circuit breakers.

Removed completely from Table 8 of M-293 were generators with steam turbines, hydro turbines and those powered by diesel engines, soot blowers, single-phase domestic watthour meters of 25 amperes, 240 volts or less capacity, and integrating electric meters and other watt-hour meters.

All other items in Table 8 were moved from the X or XY scheduling classes to the undesignated class except oil circuit breakers of 220 volts capacity or more; air circuit breakers except AB or ET types, and metal clad switchgear containing oil or air circuit breakers, and power switchboards. In the undesignated class, monthly reports on shipments will not be required, although

WPB will be able to designate shipments of any undesignated class items by directive if it chooses to do so. The three classes in which no change was made remain on the X procedure, whereby monthly reports of planned shipments are required, subject to change by WPB, and are frozen once submitted.

It was emphasized that the change to undesignated will affect new orders, but will not retroactively unfreeze existing shipping schedules, and June reports will be required. Likewise, existing shipping schedules for those items removed completely from Table 8 will remain valid. While manufacturers of undesignated products can schedule shipments to suit themselves, it must be done in conformity with priority ratings.

•

REA Permitted to Borrow $120,000,000 from RFC

Congress passed and sent to the President last week a deficiency appropriation bill, authorizing the Rural Electrification Administration to borrow an additional $120,000,000 from the Reconstruction Finance Corporation for loan funds in fiscal 1946.

The bill also carried $650,000 for additional administrative expenses, and brought the total loan funds available for allocation in fiscal 1946 to $200,000,000.

As reported by the House Appropriations Committee, the deficiency bill authorized only $50,000,000 for additional loan funds for REA in the present fiscal year, but the figure was raised on the floor to $120,000,000 and the Senate agreed. Chairman Malcolm Tarver, Georgia Democrat and chairman of the appropriations subcommittee which considered the bill, opposed the move to increase the authorization to $120,000,000 on the grounds that REA had been unable to use all the funds it had in the fiscal year just ended.

Altogether, REA will have about $300,000,000 available for construction in fiscal 1946. When U-1 was amended May 12 to allow construction of lines up to a value of $25,000, it had $100,000,000 in allocated but unexpended funds. The 1946 Agriculture appropriation bill added $80,000,000, and the deficiency bill added another $120,000,000.

•

Nashville Surcharge to Go

Nashville Electric Board has voted to remove a surcharge of 15 percent on power used by commercial and industrial consumers, effective August 1. Residential users were not affected by the action.

MARYLAND'S HERO—Sgt. Paul J. Wiedorfer, only living Marylander to have received the Congressional Medal of Honor in World War II, receives the congratulations of Charles M. Cohn, president of Consolidated Gas, Electric Light & Power Co. of Baltimore, while Harry A. Sharrett, assistant to the vice-president, holds the chest of silver presented to the power transmission station operator at a testimonial attended by over 1,000 fellow employees. The sergeant won the medal in action in Belgium and was wounded later in Germany. He is believed to be the first utility man to get the Congressional Medal of Honor

Virginia Electric Adopts New Rural Lines Policy

Stating frankly that it is entering into competition with the Rural Electrification Administration, Virginia Electric & Power Co., through its president Jack G. Holzclaw, has announced that it will build 3,200 miles of rural transmission lines as soon as materials are available.

The company has abandoned its policy of requiring consumers to build lines from transmission lines to the point of consumption and has adopted this policy:

1. The utility will deliver electricity to the point of consumption. The mileage of these lines is not included in the 3,200 miles of transmission lines.
2. The company will construct rural extensions at no cost to consumers, provided the assured monthly revenue is not less than $6 per mile.
3. The minimum monthly bill per customer will be $2.
4. The rates charged will be the same rates now prevailing in company territory. The $2 minimum will apply toward the purchase of current at those rates.

Safford, Ariz., Votes Purchase of Utility

The Arizona Power Authority won a moral victory and virtually lost another last week in its quiet maneuvering to establish a system of cooperatives and municipally owned power distribution systems throughout the state to market Colorado River hydroelectric power after the war.

A moral victory resulted when residents of Safford, after a two-year political battle, went to the polls and voted 159 to 28 to purchase the properties of Arizona General Utilities Co., which serves the city, nearby Thatcher and Pima and surrounding agricultural area in eastern Arizona.

Two years ago Safford voters turned down purchase of the utility only to have residents of Thatcher vote to buy it and approve a $400,000 bond issue for the purchase. Irate Safford property owners filed suit and appealed to the Arizona Supreme Court, which ruled the sale illegal, holding residents of the tiny community could not purchase a utility property located in another community.

Central Arizona Light & Power Co., the state's largest private utility, dealt the Power Authority's maneuvering a jolt, however, when it went into the area of the newly formed cooperative in Western Maricopa county. It built lines and delivered domestic service to virtually all of the members who petitioned creation of the co-op, which had no hope of obtaining service until after the war. Only a few weeks before, according to the co-op's officers, the utility had turned down requests for service on grounds it was not allowed to build extensions because of the war effort.

Meanwhile in Tucson another fight to purchase the Tucson Gas, Electric Light & Power Co. moved a step nearer conclusion after negotiations between the city and Federal Light & Traction Co. of New York, which has been ordered to divest itself of the property, had broken down. The city council voted to institute condemnation proceedings against the property for which the New York firm has been asking $9,000,000.

Voters of Tuscon already have authorized purchase of the utility but no bond issue has been voted as yet, pending the negotiations on the price.

•

On West Virginia P.S.C.

C. E. Nethken has been named chairman of the West Virginia Public Service Commission by Gov. C. W. Meadows. John B. Smith has been named a member for a term ending May 31, 1951.

Northwest Utilities Deny Sales to Power Districts

Rumors Concerning Sales Lead Frank McLaughlin, Puget Sound Power & Light, and Kinsey Robinson, Washington Water Power, to Issue Denials—Rumors Attributed to Activities of Guy Myers with P.U.D.'s

Conjecture and rumor over public-private power relationships in the Pacific Northwest last week cleared materially when Kinsey M. Robinson, president of Washington Water Power Co., Spokane, declared that American Power & Light Co. had no intention of selling W.W.P. common stock.

Similar sell-out rumors involving Puget Sound Power & Light Co. in Seattle brought forth a statement from company officials that no offer had been received from any source for its facilities.

Reached in New York, Frank McLaughlin, president of Puget Sound, stated that although he understood Guy C. Myers and P.U.D.'s were preparing a purchase offer, so far none had been presented. He did not know when one would be received and "any talking before we receive an offer is in the realm of loose conversation and idle speculation."

Will Never Be Sold

Quoting H. L. Aller, head of American, Robinson said that American holding of W.W.P. common stock "had never been for sale, were not now for sale, and would never be for sale."

Amid considerable speculation on possible origins of stories that claimed most of Washington state's private power facilities were in a process of transfer to public ownership, it was pointed out that Myers' contracts with western Washington P.U.D.'s, whereby he acts as their agent in any purchase deals or financing, expire July 15. Some observers thought that negotiations for renewal of these contracts might have been responsible for current publicity.

Some rumors may have stemmed from a recent statement by Dr. Paul J. Raver, Bonneville Power administrator, who told a Wenatchee, Wash., meeting that "although we have no first hand information, we have heard that every public utility district in the area served by Puget Sound Power & Light Co. has signed a contract with a private agent to acquire distribution properties, and also has signed a 50-year exclusive power contract with an undisclosed seller. We have nothing against such an acquisition provided the price is right, but so far we have not been consulted on the deal. We are completely in the dark."

Raver apparently referred to negotiations between Myers and the P.U.D.'s regarding proposed purchase of Puget Sound properties and recent statements by Frank McLaughlin, president, regarding the company's attitude. Rumors apparently were expanded to include Washington Water Power, possibly as a part of the continuing propaganda program favoring public ownership of all Washington state electric facilities.

In his statement, Robinson revealed that plans to form a single north west company incorporating W.W.P., Pacific Power & Light Co. and Northwestern Electric Co. had been dropped by American. Instead, he said, an application to SEC was being prepared for an integrated system to include those three utilities plus possibly Montana Power Co.

If approved by SEC, the stock of this integrated company would be distributed to common and preferred stockholders of American Power & Light. He declared that neither American nor W.W.P. had had any discussion with Myers and said:

"If there is any foundation to the statement that Myers and his Wall Street bankers are trying secretly to prepare this deal and unload it on the people, they are using the same strategy in finance that the Japs did in a military way at Pearl Harbor. For the sake of huge personal profits, they would try to ram public ownership down the throats of the people of the Washington Water Power Co. area, 95 percent of which has either rejected public ownership or has not even been interested enough in public ownership to even vote on the question.

"This forthright expression of public opinion leaves no doubt in our minds that the people we serve are willing and anxious to have the Washington Water Power Co. continue its service and wholly disinterested in any plans of Guy Myers and his banker associates."

•

Sullivan Will Go to Italy to Be Utilities Director

A. H. Sullivan, general office engineer of the Tennessee Valley Authority power department in Chattanooga and formerly assistant chief electrical engineer of TVA, expects to leave shortly for Rome where he will become director of the public works and utilities sub-commission of the Allied Commission in Italy, Sicily, and Sardinia.

In his new position, Sullivan will assist the Italian government and will have charge of the rehabilitation of all Italian public utility facilities, including power plants, transmission lines and distribution systems, municipal water works, sanitary and sewage disposal systems, highways and bridges, public buildings, ports and harbors and will be in charge of the housing program.

Sullivan has been with the TVA since March 1, 1934. For five years, immediately prior to his connection with TVA, he was the chief electrical engineer in charge of design and construction on the Cincinnati Union Terminal Co.

FEDERAL POWER COMMISSIONER—Nelson Lee Smith is sworn in for a 5-year term as a member of the FPC by Justice David A. Pine of the District Court of the United States for the District of Columbia. At the left of the judge are Chairman Basil Manly, Commissioner Claude L. Draper, and Vice-Chairman Leland Olds

Trimming Discussed From 3 Viewpoints

Asplundh Tree Expert Co. Holds Annual Supervisors Meeting—Mechanical Aids Demonstrated

Tree diseases and their prevention, trimming and its effect on public relations, and line clearance necessary for maintenance of service were the major subjects discussed at the Asplundh Tree Expert Co.'s annual supervisors meeting in Jenkintown, Pa. on June 28 and 29.

Dr. James Walter, United States Department of Agriculture, discussed the scientific and research viewpoint in a talk entitled, "Tree Diseases as They Relate to Line Clearance." He described the symptoms of several diseases and suggested four ways that trimmers could assist in preventing disease spread.

Gordon S. Heylin, Detroit Edison Co., presented the operating man's interest in tree trimming in a paper entitled "Importance of Line Clearance for Maintenance of Utility Service." Joseph Kaylor, forester for State of Maryland, presented the state and municipality's interest in the problem in his talk entitled, "Roadside Trees as They Relate to Line Clearance."

Trimming Aids Demonstrated

Two tree trimming aids were demonstrated to the supervisors who came from 23 states and to 21 eastern utility transmission and distribution executives. The first aid was a truck body, designed from suggestions offered by the field operating force and the second, a Disston power driven saw.

Dr. Walter stated such diseases as Dutch Elm and canker stain diseases are still of grave concern. He suggested that crews report all infected trees to the local forester, that all cut elm be burned, and that infection is less likely to ocur in trees trimmed during December, January and February. In his fourth point, that of spreading contamination he suggested that all tools be disinfected with denatured alcohol, that ropes be soaked in formaldehyde and that wounds be dressed with a 0.2 percent mercurous nitrate made according to U. S. Specification TTV 51.

J. J. Burri, Staten Island Edison Co., stated that tree diseases are a serious problem to the operating companies and that efforts should be made to increase research in these fields rather than allow it to decrease.

Heylin stated that tree troubles had caused an average of 234 primaries down each year for the last 10-year period. Most of these occurred during storm periods with limbs and trees of the softer type causing more of the difficulties than the hard woods. He stated that meetings have been held with the State Forestry Association so that some standardization might result on the types of trees to be planted and their location relative to the lines.

Kaylor explained the Maryland statutes as they effect trimming. The state prevents tree removal 50 ft. each side of the highway so that there will be no brush and slag in the ditch. He pointed out that this results in an advantage to utilities since it minimizes possibilities of fires caused by motorists and subsequent damage to poles. He complimented those who use bulldozers in clearing right-of-ways since it provides an additional fire break in timbered areas.

TREE TRIMMING, THE ASPLUNDH WAY—Utility transmission and distribution executives, upper picture, and Asplundh supervisors witness the first tree trimming demonstration with the "field force" designed truck. The chassis is a standard 1½-ton Chevrolet, and the body features all known safety and speed devices for trimmers. Lower, demonstration of Disston power saw which made 3 passes through an 18-inch red oak tree in one minute. The saw was also used to fell the tree

•

Savoy, Mass., to Get Light

Savoy, Mass., will get its first electric lights this summer when the Western Massachusetts Electric Co. extends its lines into the town.

Washington Loses Taxes When Utility Goes Public

Acquisition of property within a school district by the federal government, state, or public utility district removes such property from the tax rolls and from the operation of subsequent tax liens, the Washington attorney general's office recently advised Superintendent of Public Instruction Pearl A. Wanamaker.

Mrs. Wanamaker inquired whether in the instance of a school district having issued bonds, the public utility property would remain obligated for the payment of a proportionate share of the bonded indebtedness outstanding at the time of acquisition.

The attorney general found that such bonds represent an indebtedness of the school district which must be funded by the taxes levied only against the taxable property of the district, and that acquisition by a P.U.D. would remove the public utility property from such liability.

A.I.E.E. Holds Short Meeting in New York

Reports Indicate Successful Year —Mortensen Gets Lamme Medal —Wickenden Elected President

Reports indicating that the American Institute of Electrical Engineers has concluded another successful year were presented last week in New York as the Institute held its annual meeting, a 90-minute session replacing the usual five-day meeting.

Dr. Soren H. Mortensen, chief electrical engineer of the Allis-Chalmers Manufacturing Co., was presented with the Lamme Medal for 1944. The institute prizes for papers presented during 1944 were also awarded.

Following announcement by President C. A. Powel, Westinghouse Electric Corp., that the entire slate of officers chosen by the nominating committee had been elected, Dr. William E. Wickenden, president of Case School of Applied Science, was presented with the president's badge of the institute. In a brief response, Dr. Wickenden declared that the future of the institute rests in its student branches and expressed satisfaction that membership in these branches had fallen off about 10 percent despite the great decrease in college enrollment.

Charles Skinner Honored

The election of Dr. Charles E. Skinner, founder of the Westinghouse Research Laboratories, as an honorary member was announced.

Increased activity of the 73 sections of the institute was noted in the report of the board of directors which was summarized by H. H. Henline, national secretary. Section meetings increased from 738 in the fiscal year ending April 30, 1944 to 884 in 1945. Membership increased from 21,407 to 23,072.

R. S. Fleshiem, manager of the Electrical Department, Allis-Chalmers, presented Dr. Mortensen for the Lamme Medal. The recipient who was honored "for his pioneer work in the development of self-starting synchronous motors and for his contributions to the development of large hydraulic and steam-turbine-driven generators, responded with a description of the progress made in four decades in motor and generator design.

The following institute prizes were awarded:

Best paper in the field of engineering practice, "Electric Automatic Pilots for Aircraft," by P. Halpert and O. E. Esval, Sperry Gyroscope Co ; honorable mention, "Development of Excitron-

CONGRATULATIONS—C. A. Powel, president of the American Institute of Electrical Engineers, congratulates Dr. Soren H. Mortensen, Lamme Medal winner for 1944.

Type Rectifier," H. Winegrad, Allis-Chalmers.

Best paper in the field of theory and research, "The Geometry of Arc Interruption, II" E. W. Boehne, General Electric Co.; honorable mention, "Effect of Altitude on Electrical Breakdown and Flashover of Aircraft Insulation," L. J. Berberich, G. L. Moses, A. M. Stiles, and C. G. Veinott, Westinghouse.

Prize for initial paper, "Crossbar Toll Switching System," L. G. Abraham, A. J. Busch, and F. F. Shipley, Bell Telephone Laboratories; honorable mention, "Transient Performance of Induction Motors," F. J. Maginniss and N. R. Schultz, General Electric.

•

Court Will Not Intervene in Baltimore Rate Case

A move by the Rustless Iron & Steel Co. to have a memorandum opinion of the Maryland Public Service Commission declared invalid failed recently when Judge Emory H. Niles of the Circuit Court dismissed the complaint.

The opinion which Rustless sought to have declared invalid was that the business of the Consolidated Gas, Electric Light & Power Co. of Baltimore should be determined as a whole in determining rates for electricity.

Rustless contended that the gas and steam heating business of the utility should have no bearing in determining its electric rates and presented this contention at hearings before the P.S.C. which have not yet ended.

Judge Niles ruled that the steel company can do nothing further until the Public Service Commission has made its final ruling.

Analyze Northwest Industrial Program

Members of Northwest Electric Light & Power Association Study Plans for Post-War Development

Industrial development programs of the member utility companies of the Northwest Electric Light & Power Association were reviewed at a meeting of the Association's Industrial Development Committee in Seattle, June 20. C. T. Bakeman, Puget Sound Power & Light Co., chairman of the committee, presided.

O. C. Mayer, Idaho Power Co., stated that his company was emphasizing small five to 25-man industrial enterprises, and was including in the program, opportunities for commercial expansion in the communities served by the company. The company had assisted in community surveys which indicated the types of businesses that could be established, and had done considerable research for small industries.

These surveys had indicated possibilities for starch manufacture, the quick freeze of Idaho fruit, the fertilizer industry, and certain wholesale and retail opportunities in different lines. This type of program appealed to the businessmen in the smaller communities served by the company, Mr. Mayer stated.

Industrial Research Desired

Among the activities in the inland empire area around Spokane, as portrayed by L. V. Ross, Washington Water Power Co., were assistance to the state college in securing funds for setting up an industrial research division. Need was also found for coordination of all agencies entering into industrial and market research, and the company took the leadership in organizing an Industrial Advisory Council, consisting of representatives from the railroads, Chambers of Commerce, the Bonneville Power Administration, and certain large industries. The company was carrying on a continuing research to attempt to measure the size of the job to be done in absorbing the labor eventually to be released from war industry.

E. C. Branch, Pudget Sound Power & Light Co., explained the survey conducted in Bellingham, Wash., in which the company took the leadership in getting the Chamber of Commerce to organize group action with 14 sub-committees working on different parts of the survey under an over-all committee. This survey, which has been a year in the making, will set forth analysis of all factors entering into industrial development for that community.

H. Cleland Points Out P.C.E.A. Achievements

Tells Sectional Gatherings That G. I. Joe Booklet and Home Planning Institutes Were Outstanding

Two accomplishments were cited as outstanding by Hance H. Cleland, San Diego Gas & Electric Co., president of the Pacific Coast Electrical Association, in reporting before one-day meetings of the Association, one held in Los Angeles June 21, the other in San Francisco June 28. These were the issuance of a booklet on obligations to returning G. I. Joe, which went to executives of 5,000 corporations throughout the country under the name of the association. The other was the sponsorship of 55 home planning institutes in California that carried the story of adequate wiring and electrical uses in the home to more than 100,000 prospective new home builders. The regional meetings restricted attendance largely to local men and were so arranged to cooperate with ODT in restricting travel.

Air Circuit Breaker Described

Those of the operating economics section, north and south, learned of the development of preformed armor rods to protect transmission conductors from damage due to vibration and other causes, from T. F. Peterson, American Steel & Wire Co. A new indoor air circuit breaker in the 15-to-34.5 kva. range with interrupting capacity up to 2,500,000 kva. was described by A. W. Hill, Westinghouse Electric Corp.

O. B. Falls, Jr., General Electric Co., demonstrated a fault selective relaying system that trips the breaker instantly upon fault so that sectionalizing fuses will not blow, but upon reclosure incorporates a time delay that will blow the fuse and isolate a faulted section. He also showed that a combination of regulators and shunt capacitors can result in more economical loading of long rural distribution lines.

The two meetings of the administrative services section served as open forums for comparing experiences and practice in handling job classification work. Effect on personnel and the necessity of giving personnel more information on job classification, its purpose and equity, were stressed. Another topic was practices of member companies in collecting from war workers here today and gone tomorrow. Discussion on credit status of small plants going from government contracts to peacetime work, also brought forth a beneficial exchange of ideas.

Interest in meetings of the business development section centered around post-war plans, training and market potentials. C. E. Greenwood, Edison Electric Institute, outlined the commercial program of that association with particular reference to new sales training courses to be put out. Applications and trends in home lighting and the woman's angle to decorative lighting problems in the home were presented by Miss Mary Webber, General Electric. Po ential market for home freezers and factors affecting their sales and use were discussed by Dr. D. K. Tressler, of the same company. A paper by Paul Zimmerman, Indoor Climate Institute, and a round table discussion with particular reference to possibilities of the heat pump, round out the meetings of this section.

President-elect of the association is K. M. Ryals, Stone-Ryals Electric & Mfg. Co., San Francisco.

•

Youngstown Utilities Tax Upheld by Lower Court

Right of Youngstown, Ohio, to impose a 2½ percent tax on utilities bills has been upheld by Judge Erskine Maiden, Jr., in a suit brought by a taxpayer on the ground that the state already was taxing utilities; so the city had no right to enter the field. Judge Maiden continued his earlier order impounding the funds until the case is finally decided by higher courts.

Similar suits were brought by the Youngstown Real Estate Board and City Law Director John W. Powers. The latter also contended that city council had exceeded its corporate powers.

•

Water System Sold

Georgia Power & Light Co. has sold the complete water system, including buildings, in Donalsonville, Ga., to the municipality for a reported $25,000.

Paper Is Ammunition

Paper is scarce today because over 700,000 different war items are wrapped, labeled or made from paper or container board. The war in the Pacific increases the demand because products going to that area require double and triple packing for protection against weather and insects.

So share your ELECTRICAL WORLD; the number of copies is limited.

Keep in operation in your office and plant a continuous drive to collect all waste paper for salvage. Contribute your dead correspondence, obsolete records, useless display material, and unusable cartons.

Interior Fund Bill Goes to President

$111,690,258 Budget Agreed Upon by Congress—Fight for Shasta Steam Plant Will Continue

The House and Senate agreed last week to the conference report on the $111,690,258 Interior Department appropriation bill for 1946 and sent it to the President after public power exponents made it unmistakable that they will insist at the next opportunity on appropriation of funds for the construction of a steam plant to firm up hydro energy generated at California's Shasta Dam and for a transmission line network to move Shasta output.

It was not immediately clear whether the attempt would be to get funds for planning these projects, denied in the 1946 Interior appropriation bill after bitter argument, or whether the attempt would be to get construction funds, nor was it clear whether the move would await the 1947 appropriation bill or would be included in the first possible deficiency bill. But whatever and whenever, the fight will be carried on until it is won, several members promised, as they asserted that the conference committee's comment on the dispute represented considerable of a relaxation from the flat prohibition on the projects contained in the report of the House Appropriations Committee.

As sent to the White House, the bill represented a slash of $32,148,889 from Budget Bureau estimates for the Department in fiscal 1946, and a reduction of about $21,500,000 under the amount of the bill as passed by the Senate. It was $10,447,630 larger than the bill as passed by the House.

Amendments affecting the Reclamation Bureau which had been left in disagreement by the conference committee were compromised with no difficulty as the bill was pushed to final passage by June 30, the end of fiscal 1945. Many of these, affecting the length of time during which funds were to remain available, were settled by agreement on a date of June 30, 1947, a year after the original House-approved expiration date. The Senate had amended the bill to provide that funds be available until expended.

•

Georgia Power Will Build

Georgia Power Co., through Vice-President C. A. Collier, has announced that 500 miles of new electric lines to serve 2,500 farms in Georgia will be constructed by the company during the present year.

Court Sanction for Hetch Hetchy Pact to Be Asked

San Francisco, finding itself in a stalemate on the troublesome Hetch Hetchy power squabble, has decided to defy Secretary of the Interior Harold L. Ickes and fight for Federal Court approval of the city's new power contract.

Regardless of whether the Secretary approved or rejected the contract early this week, city fathers, who for a year have been attempting to devise a sale plan compatible with views of the Interior Department, were agreed to ask, and if need be to battle, for court acceptance of the contract as now written. And this the adamant Mr. Ickes has frowned on three times.

July 2 was the effective date of a Federal Court injunction banning further Hetch Hetchy sales to the Pacific Gas & Electric Co., the date by which the intent of the Raker Act as interpreted by Mr. Ickes and the desires of the city to preserve maximum power revenues were to have been reconciled in a mutually satisfactory contract.

The contract now provides that the city will lease P. G. & E. transmission lines to deliver power to San Francisco, sell additional power to Modesto and Turlock irrigation districts and Kaiser industries, and dispose of dump power to P. G. & E.

Mr. Ickes is asking that the irrigation districts guarantee they will not use Hetch Hetchy power to make available their own electric energy to the private utility, a demand they refuse on grounds their own power is their own business.

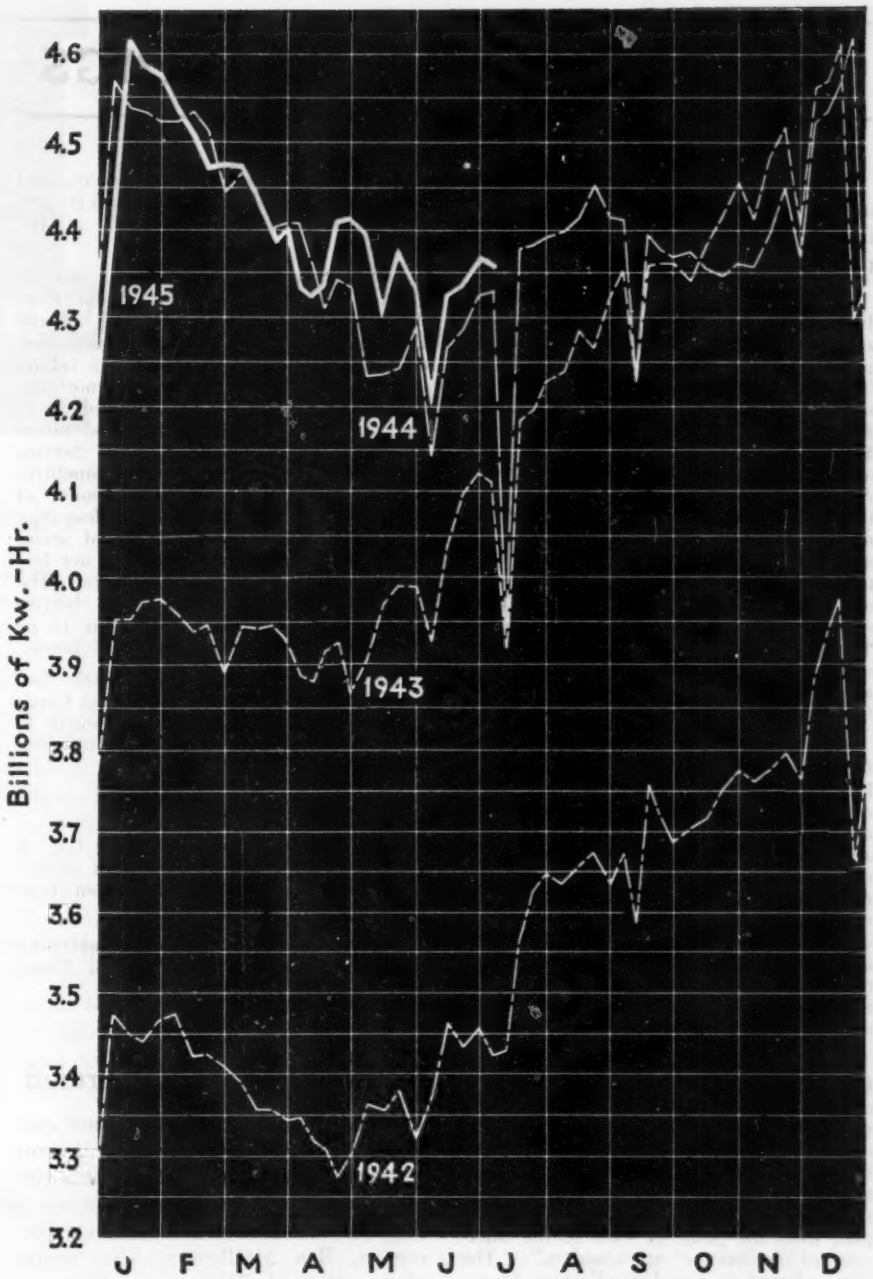
•

Reclamation Bureau Paid for Boulder Plant Costs

Advance payment of $8,000,000 to the U. S. Bureau of Reclamation was authorized by the Los Angeles Board of Water and Power Commissions, May 22, to apply on the Department of Water and Power's obligation to repay costs of generating machinery and equipment at Boulder dam power plant.

Available cash in the power revenue fund will enable payment of 14 yearly installments without issuance of bonds. Elimination of the 3 percent interest on the annual payments will result in savings estimated at $1,925,000.

"The annual installment for amortization of generating machinery allocated to the municipal system, plus annuity for replacement, runs approximately $712,000 at the present time", said Edward A. Dickson, the board's finance committee chairman. This figure includes the interest which will be eliminated by the advance payment.



Electric Output Curve Turns Downward

The electric output curve moved downward during the week ended June 30, 1945, according to figures released by the Edison Electric Institute. The amount of electrical energy distributed by the light and power industry totaled 4,353,351,000 kw.-hr., compared with 4,358,277,000 kw.-hr. during the preceding week. During the week ended July 1, 1944, the amount of electrical energy distributed amounted to 4,327,359,000 kw.-hr., this year's figure representing an increase of 0.6 percent.

Five of the seven major geographical regions of the country reported increases over last year, the New England States moving into the plus column, with an increase of 1.1 percent. For the week ended June 23, that group showed a loss of 1.3 percent as compared with last year.

Weekly Output Millions Kw.-Hr.

1945		1944		1943	
June 30	4,353	July 1	4,327	July 3	4,111
June 23	4,358	June 24	4,325	June 26	4,120
June 16	4,348	June 17	4,287	June 19	4,098
June 9	4,327	June 10	4,265	June 12	4,040
June 2	4,204	June 3	4,144	June 5	3,926
May 26	4,330	May 27	4,292	May 29	3,990
May 19	4,377	May 20	4,246	May 22	3,992
May 12	4,302	May 13	4,238	May 15	3,969
May 5	4,397	May 6	4,234	May 8	3,904
Apr. 28	4,416	Apr. 29	4,336	May 1	3,867
Apr. 21	4,411	Apr. 22	4,344	Apr. 24	3,925
Apr. 14	4,332	Apr. 15	4,307	Apr. 17	3,917

Percent Change From Previous Year

	Week Ending		
	June 30	June 23	June 16
New England	+ 1.1	— 1.3	— 0.3
Mid Atlantic	+ 2.3	+ 2.8	+ 2.2
Central Industrial	— 0.5	— 0.2	+ 0.9
West Central	+ 1.2	+ 1.5	+ 5.0
Southern States	+ 3.8	+ 3.2	+ 7.0
Rocky Mountain	+ 1.3	+ 0.9	— 1.0
Pacific Coast	— 2.9	— 1.7	— 4.3
Total United States	+ 0.6	+ 0.8	+ 1.4

SEC DECISIONS—HEARINGS

The Securities and Exchange Commission in a series of orders recently issued affecting electric utility companies:

APPROVED PROPOSAL of Commonwealth Utilities Corp. to sell its holdings in Arizona Power Corp. to James C. Tucker, president of Arizona Electric Power Corp. Commissioner Robert E. Healy was in vigorous dissent. Mr. Tucker will pay $999,650 for 14,920 shares of common and $15,400 for 200 shares of preferred stock of Arizona Power. He proposes to merge Arizona Power Corp. and Arizona Electric Power Corp. into Arizona Power Co., newly organized, to continue as the consolidated company. It is proposed also to redeem the outstanding preferred stock of Arizona Power Corp. at the call price of $105 a share, plus accrued dividends. The proposed merger and issue of new securities by the surviving company have already been approved by the Arizona Corporation Commission.

HAS ISSUED an order permitting the financing proposal of Portland General Electric Co. to become effective. The company plans to sell at competitive bidding $34,000,000 of first mortgage bonds and to sell to banks $4,000,000 of 2 percent 10-year serial notes. The interest rate on the bonds will be determined by competitive bidding. Proceeds of the sale of the bonds and notes, together with other funds of the company, will be used to redeem $39,565,000 of first and refunding mortgage bonds, 4 1/2 percent series, due 1960, at 102 plus accrued interest.

HAS ASKED the United States Circuit Court of Appeals for the 2d Circuit to dismiss the petition of Randolph Phillips, a common stockholder of United Corp. and to affirm the orders of the S.E.C. to which he took exception. In its brief, the commission contended that Mr. Phillips "has no standing to urge objections to the plan from the point of view of the interests of preference stockholders." The plan referred to was United's plan to exchange some of its portfolio holdings of common stock of Philadelphia Electric Co. one of its then most important subsidiaries, for shares of its own outstanding $3 cumulative preference stock and accrued dividends on the latter security.

HAS APPROVED proposed sale of the natural gas properties of Pennsylvania Electric Co. to Peoples Natural Gas Co. Joint application for the $1,194,825 transaction was made by Associated Electric Co. and Pennsylvania Electric, a subsidiary. Peoples, a wholly owned subsidiary of Consolidated Natural Gas Co. supplies natural gas to consumers in Pittsburgh, Altoona, Greensburg and Latrobe.

Applications Filed

NEW YORK STATE Electric & Gas Corp. has filed a registration statement, covering the issuance of $10,000,000 of first mortgage bonds, due in 1975, and 150,000 shares of $100 par value cumulative preferred stock. The company intends to use the proceeds to redeem $13,000,000 of first mortgage gold bonds, 3 3/4 percent series due in 1964, at 106 percent, and to redeem 120,000 shares of its 5.10 percent cumulative preferred stock at 107 percent.

PUBLIC SERVICE CO. of Indiana has requested the commission to exempt from the provisions of section 6 (B) of the Holding Company Act its proposed issuance and sale of new securities to refund its $59,314,500 of outstanding mortgage bonds and $14,818,590 of preferred stock, and to prepay $7,750,000 of serial notes. To effect this refinancing, Public Service proposes to issue and sell at competitive bidding $48,000,000 principal amount of series F bonds, to be sold at not less than face value, and 150,000 shares of series B preferred stock, to be sold at not less than par, plus accrued dividends. The company also proposes to borrow $13,000,000 from banks, the loans to be evidenced by its one to ten year notes.

GENERAL WATER, Gas & Electric Co., subsidiary of International Utilities Corp., has filed an application for authority to dispose of its stock interest in Rockland Gas Co., Inc.

Hearings Scheduled

JULY 11: On New England Gas & Electric Assn.'s proposed plan of recapitalization. The hearing had been postponed from a previous date.

JULY 17: On amended recapitalization plan filed by New England Power Association.

•

Authority Board Confirmed

Sam K. Seymour, Jr. has been confirmed by the Texas Senate as a director of the Lower Colorado River Authority after the Senate had turned down a previous nominee of Gov. Coke Stevenson, Ben McIlhenny. The Senate also confirmed Thomas C. Ferguson and R. D. Wright as directors. Terms of the three men will end January 1, 1951.

UTILITY REPORTS

	Net Income 1945	1944
*Alabama Power	$3,947,006	$4,262,389
*Central Arizona Light & Power	779,685	850,152
*Connecticut Light & Power	3,899,340	3,668,369
*Consolidated Gas Elec. Lt. & Pwr. (Balto.) and sub.	6,537,521	6,556,802
*Consumers Power	7,071,392	7,718,990
*Detroit Edison and subs.	6,373,223	8,567,566
†Electric Bond & Share and subs.	4,022,792	5,331,142
*Georgia Power	4,841,989	5,458,420
*Houston Lighting & Power.	3,149,996	2,889,980
*Ohio Edison	3,513,209	3,717,462
†Savannah Electric & Power	377,079	409,711
*Texas Power & Light	2,670,261	2,689,471
*Utah Power & Light and sub.	1,831,376	2,265,907

*Twelve months ended May 31.
†Twelve months ended March 31.

Puget Sound Says Rates Are Lower Than P.U.D.'s

Sprinkled with barbed references to Washington's public utility districts and Federal power projects, the annual report of Puget Sound Power & Light Co. was released recently, showing unprecedented gains in the company's revenues and the greatest power production increase in its history.

The report on P.S.P. & L., one of the state's major private power companies which has long feuded with public utility districts, was prefaced with figures showing glaring contrasts in the private-public power issue.

The company asserted its average rate for homes and farms was 40 percent less in 1943 than in 1933, while the average rate of P. U. D.'s in '43 was 20 percent above the utility's, and that the company paid $18,000,000 in taxes from 1939 to 1944 while the P. U. D.'s levied $1,500,000 in taxes against property in the state.

During the past year, Puget Power's president, Frank McLaughlin, said, the company drove its generators to an all-time high delivery of 1,634,631,972 kw.-hr. of electric energy which was 14 percent above the previous high of 1943, and about double the volume of 1934.

The company paid $5,706,626 in taxes, an increase of $1,872,296 or 48.8 percent over 1943, which amounted to 20.5 cents out of every dollar of the firm's 1944 revenues, the report stated.

Operating revenues hit a new high of $26,589,538, a gain of $1,884,487 or 7.6 percent over 1943, but the net earnings, after providing for greatly increased taxes and operating costs, were reduced to $5,144,934, or $253,308 less than in 1943.

•

Krug Pleads for Storing of Soft Coal in Summer

WPB Chairman J. A. Krub has reiterated his urging that large-scale coal users of bituminous coal stockpile as much as possible this summer, and warned that production is now being jeopardized by failure of consumers to take certain lower grade coals.

Stockpiling, which he described as "patriotic cooperation," is the only way it will be possible to lessen the impact of the coal shortage on war production next winter, Krug went on.

Krug quoted the Solid Fuels Administration for War to the effect that there will be a shortage of perhaps as much as 25,000,000 tons, and added that "the pressure on war production and transportation in general has been little changed by the arrival of V-E Day."

How

DESIGN · CONSTRUCT · OPERATE · MAINTAIN

Hose Winch Lightens Tube Turbining Task

G. A. PORTER
The Detroit Edison Co., Detroit, Mich.

Turbining boiler tubes has never been considered a boy's job. The tiresome routine of passing air hose, turbine and cutter head through even relatively short tubes, one after another, requires considerable manual effort. But when tubes are 60 ft. long turbining is downright hard work.

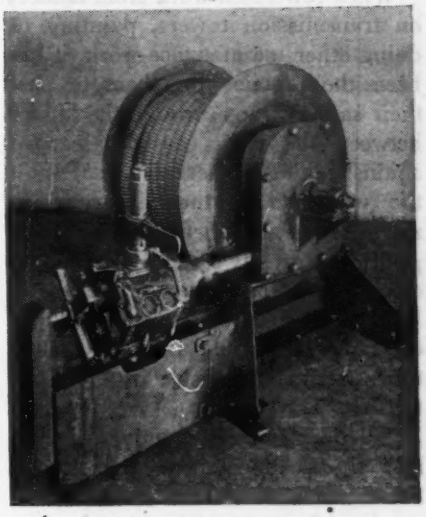
Much of the work has been taken out of the job at Detroit Edison Co. plants, however, by using an air-powered winch to raise and lower the hose and turbine. Its use, in the manner to be described, has several advantages:

1. Saving of time, manpower and physical efforts.

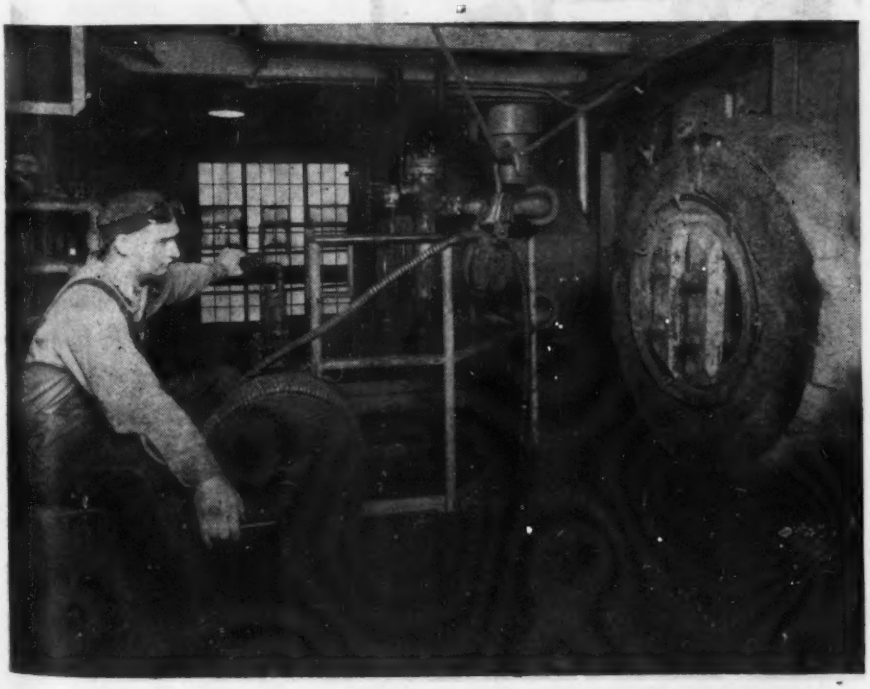
2. Saving of hose. The hose is either on the winch drum or in use and is not lying where it can kink or be damaged by objects falling on it. Long hose lengths laying around the floor are a safety hazard.

3. A better job of turbining. The turbine moves along the boiler tube at constant speed; about 30 ft. per min. going down and about 60 ft. per min. returning. These speeds have been found to be correct. With manual handling of the hose the turbine movement was erratic and turbining was considered nonuniform.

Formerly, when boiler tubes were to be turbined it was necessary for a man to sit inside the boiler drum and by feel guide the turbine down the tube at the correct speed. Weight of the air-driven turbine, cutter head, wire-bound hose, together with the hose spraying water in each tube to keep down dust, was considerable. However, with relatively short boiler tubes it could be handled nicely by two men, one inside the drum and the other outside tending valves, helping with the hose and taking his turn inside the drum.



WINCH, powered by reversible air motor having adjustable speed, raises and lowers air hose, air-powered turbine and cutter used to remove scale from the inside of long boiler tubes



AIR-POWERED WINCH set up outside boiler drum ready to turbine the tubes. Separate compressed air supply is provided for turbining hose and winch-drive air-motor

With the advent of the newer boilers having side wall tubes 50, 60 ft. or longer, however, the job became altogether different. It was all two men wanted to do inside the drum letting down and pulling up 60 ft. of hose, turbine and cutter. Two more men were required outside to handle hose and valves and to spell the others off. Work was hard and progress slow.

Today, however, the hard work is

being done by a winch. Illustrations show the winch driven through a worm by a reversible air motor with adjustable speed. All the hose is wound on the winch drum. A swivel tube allows the hose to remain connected to the air line at all times. A separate air supply line serves the air motor.

In use, the winch is anchored outside the boiler drum and the hose is taken through the manhole over a pulley, fastened suitably to the top of the drum, and thence through the tube being turbined. On side wall tubes a grooved quadrant is attached at the hand-hole opening to prevent damage to the hose. Using this arrangement it is necessary to have only one man with the turbine and one at the winch. The man using the turbine need only guide it into the tube and signal the operator of the winch when necessary.

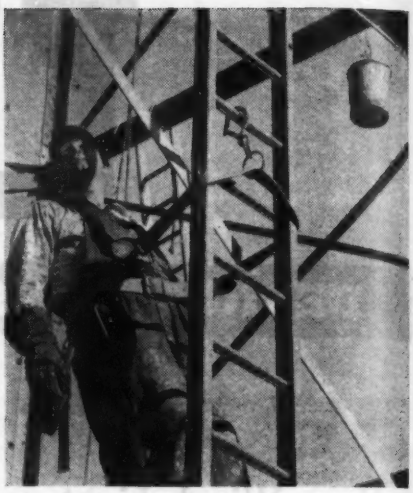


FIG. 2—Belt hooked to rung of ladder gives towermen more freedom of motion

• • •

Ladder Hook for Work on Towers

When towermen work from ladders on transmission towers, painting or doing other maintenance work, it has been the practice for them to pass their safety straps through the ladder between the rungs as a safeguard against falling. Whereas the safety of the workman is thus insured, the range of his movements from a given position is greatly restricted. Frequent changes of the safety strap are, therefore, necessary, with unsnapping of the catch from the D-ring at such times a slip can result in a serious fall.

A ladder hook assembly (Fig. 1) has been developed by Public Service Electric & Gas Co. The towerman's safety strap is passed completely around the ladder on which he is working, the strap being threaded through the 3-in. ring of the hook assembly (Fig. 2.) The hook of the assembly is secured to the ladder rung nearest the work.

As long as the towerman remains on the ladder, his safety strap is around the ladder, and vertical changes of position on the ladder are accomplished by shifting the snap hook to the appropriate rung. The

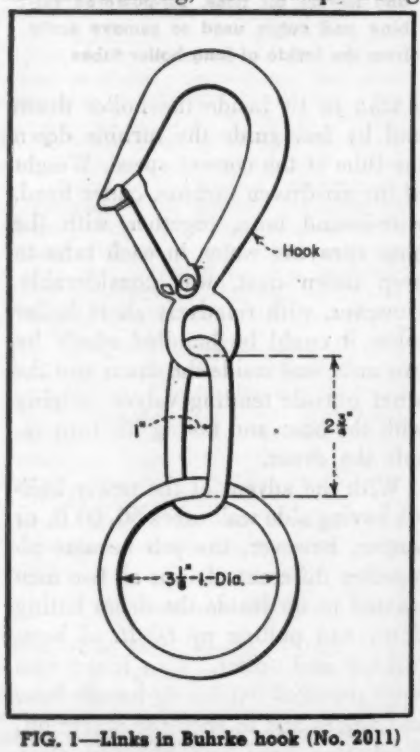


FIG. 1—Links in Buhrke hook (No. 2011) for use with ladder belts are made of ⅝-in. round stock

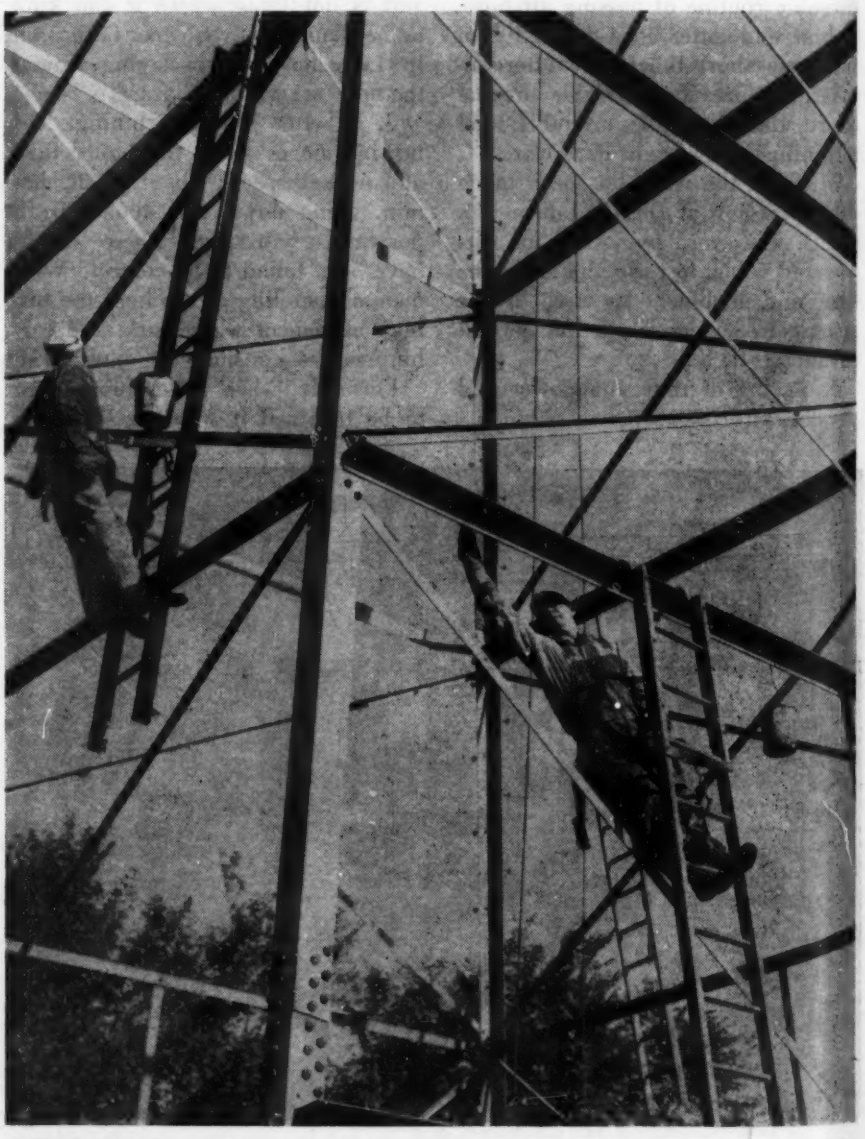


FIG. 3—Working range with the hook on the same fourth run as in Fig. 2 is greatly increased over the former method of threading belt between rungs

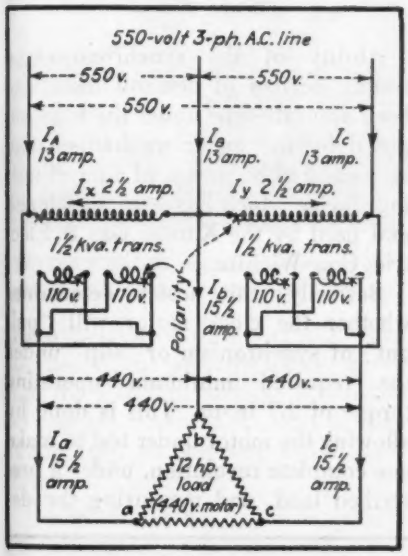
hook assembly is not normally under load, but functions only if the tower-man loses hold and footing on the ladder. Experience has demonstrated usefulness of the device as it greatly facilitates any work operation where the desired condition is maximum freedom of movement with safety.

•

From 550 to 440 by Use of 550 to 110 Transformer

W. C. NODDINGS
Master Mechanic, Raritan Copper Works, Perth Amboy, N. J.

Operation of a 440-v., 3-phase motor from a 550-v. 3-phase source was recently performed by connecting two 550 to 110-volt transformers as



CONNECTION of two 1½-kva. 550/110 transformers to serve a 440-volt motor from 550-volt source. Currents are indicated for a 12-hp. motor load

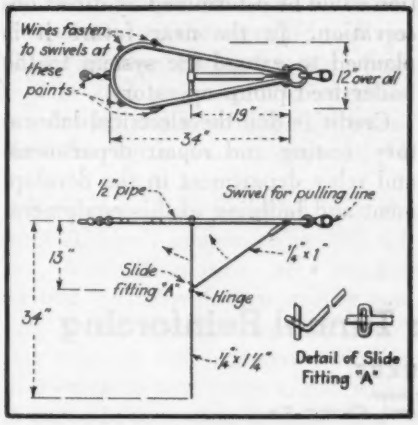
shown. This connection was resorted to since it appeared the best temporary expedient to serve the 12 hp. needed.

The transformer secondaries are connected to buck the primary. The available 1½-kva. transformers were of ample capacity to serve the purpose as the current readings on the illustration indicate.

•

Pulls Five Wires with One Line

From two to five conductors in sizes ranging up to 1/0 copper or 4/0 aluminum can be pulled in at a time with a single line by means of a device designed by Reinhold Felton, line foreman of Wisconsin Gas & Electric Co., Watertown, Wis. The "running board," so-called, is provided



RUNNING BOARD permits pulling up to five conductors at a time with single line. Hanging strap counterweight which keeps device from twisting folds back in direction of arrows to skid the board over crossarms

with a long, hinged, strap-type counterweight which serves both to keep the device from turning, as it is pulled, and twisting the wires, and also as a skid to carry the board up and over cross arms with ease. When the device comes to a crossarm the strap skid folds back flush with the plane of the wires, dropping back again when the crossarm is past to serve as a counterweight. Lateral dimension of the running board is such that it can pass between transmission crossarm pins without interference.

•

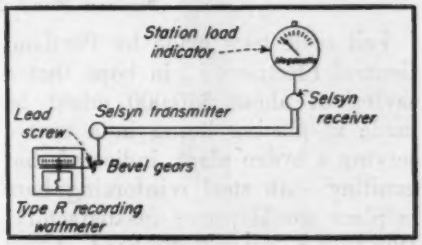
Dolly Mounted Pumps Releases the Truck

A TRUCK is no longer tied up by Philadelphia Electric Co. during manhole pumping operations. The Homelite gas-driven pump mounted on the dolly is towed to the flooded man-hole, disconnected from the truck and set-up with the jack as the third support. The unit is mounted on a 2-in. angle iron frame hung between two Ford wheels. One man is left to man the pump; the truck is free for use on other jobs.

Selsyn Operates Load Indicator

C. H. FRIER
Electrical Engineer, Generation Dept. Oklahoma Gas & Electric Co. Oklahoma City, Okla.

When Horseshoe Lake generating station of Oklahoma Gas & Electric Co., was placed under tie line load control as part of the Southwest Power Pool the operator who formerly regulated the manual-type station load indicator, located in the switchboard



SELSYN SYSTEM connected to totalizing wattmeter transmits moment-to-moment indication of station load to boiler room. Selsyn-operated indicator displaced manual indicator when station was placed under automatic load control

room, found himself unable to keep up with moment-to-moment changes in station load. Since this is essential operating information, steps had to be taken to secure this information automatically and relay it to the boiler room operators.

A Selsyn system provided the means for doing this. The lead screw driving the pen of the type R Westinghouse recording wattmeter that totalized load on the three units at Horseshoe Lake station was coupled to a Selsyn transmitter through bevel gears. This transmitter was connected to a remote Selsyn receiver that operates pointers of a 2½-ft. diameter, load indicator dial in the boiler room, again through bevel gears.

Particular pains were taken in arranging the system to eliminate all backlash from the bevel gears coupling the Selsyn system to both the recording wattmeter and indicator pointers. This action was necessary since any lost motion in the gearing would be magnified and produce a considerable error in the final reading of the indicator.

Supplementary red and green signal lamps, that flash in accordance with "raise" and "lower" impulses of the load control system, were also installed at the indicator to warn operators in the boiler room of the direc-

tion of the impending load changes.

Selsyn equipment used in making up these indicators was "borrowed," from a tap position indicator on a regulating transformer at the station. The indicator was not needed on the transformer because it was within sight of the control point and tap position could be determined by direct observation. In the near future it is planned to extend the system to the boiler feed pump operators.

Credit is due the electrical laboratory, testing and repair department, and relay department in the development and building of this equipment.

• • •

Guniting Bond Poor for Tunnel Reinforcing

JOHN BANKUS,
Chief Engineer,
Portland (Ore.) General Electric Co.

Full scale tests made by Portland General Electric Co., in hope that a saving of about $40,000 might be made in placing lining in a tunnel serving a hydro plant, indicated that guniting with steel reinforcing bars in place would prove unsatisfactory. Due to a possible static head of 250 ft. and the need for heavy steel reinforcement, it was felt that additional information was needed on placement of gunite.

To obtain this information a wooden tunnel section 14 ft. in diameter and 12 ft. long was built. In one half of this section all of the reinforcing steel was put in place before the gunite was applied.

In the second half one layer of steel was placed and then gunited over, followed by a second layer of reinforcing steel, and the process repeated. Both round and square bars were used. Guniting was done by a contractor's man with 17 years experience in placing gunite.

Forms were removed and a careful examination made. This showed a

TUNNEL TEST section built to determine feasibility of guniting with reinforcing steel in two methods of placement

pronounced tendency for the sand to fill the spaces directly back of the reinforcing bars. The gunite shell was broken by a jackhammer and loose sand was also found back of the second layer of reinforcing steel. From the results of this test it was concluded that sufficient bond could not be assured to develop the full strength of the steel.

For this reason, and also because the steel was not adequately protected against corrosion, a 9-ft. welded steel conduit was installed in the unreinforced section of the surge tank tunnel and the riser shaft.

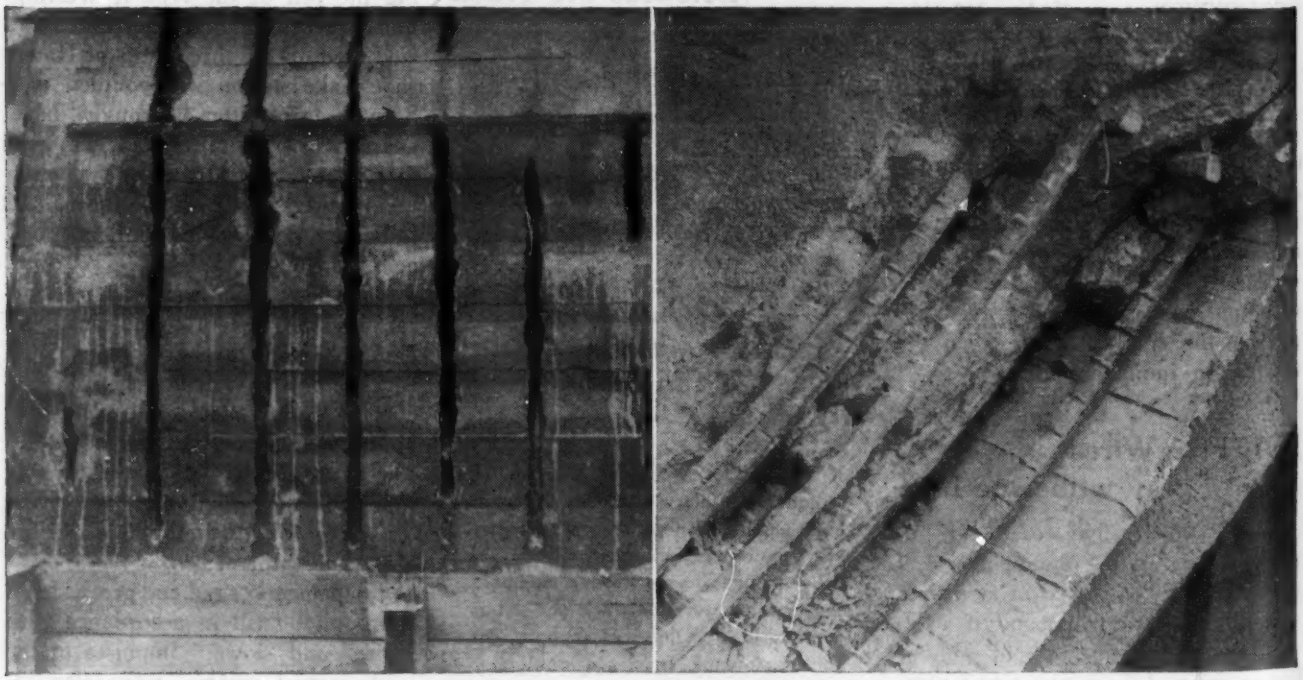
•

Check Output Torque of Interval Timers

C. E. MATSON
Meter Superintendent
Kansas Gas & Electric Co.
Wichita, Kansas

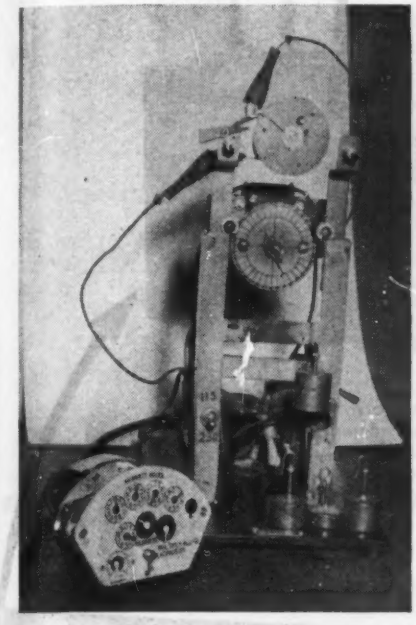
Ability of the synchronous-type timing devices of demand meters to keep accurate time under the load imposed by the meter mechanism can be measured by means of a novel testing device which has been developed and used by the Kansas Gas & Electric Co., Wichita.

Basically, this tester determines whether the clock motor will "pull out" of synchronism or "slip" under the required minimum operating torque of 2.7 in.-oz. This is done by allowing the motor under test to make one complete revolution, under a prescribed load, and measuring the de-



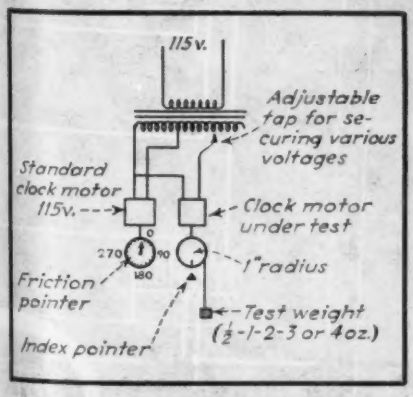
EXAMINATION SHOWED TENDENCY for sand to fill spaces back of reinforcing bars leaving voids (left) and that insufficient bond could not be assured to develop full strength of steel (right) in application of gunite

grees of rotation of a standard timing motor connected to the same sources. Obviously if the standard motor turns more than 360 deg., per revolution of the motor under test, slip has occurred and the timing device will not keep time correctly when installed in the demand meter. Since both the standard and the motor under test are synchronous devices they should keep set perfectly within their design load range.



TESTER CHECKS accuracy of synchronous timing device under load

Torque is applied to the motor under test by causing it to wind up a string-supported weight, of the proper size, on a small drum of one-inch radius, that is attached to its shaft. Shaft of the standard motor carries a friction pointer that moves over a dial calibrated in degrees. Thus with the two motors started simultaneously and stopped when the motor under test has completed one revolution, the pointer on the standard will indicate whether the two motors have kept in step properly. No variation is tolerated and in addition the motor must develop a stalling torque of 4.8 in.-oz.



SCHEMATIC DIAGRAM of device used for acceptance tests of demand meter interval timers

Both motors are supplied from the same 115-volt source. The 230-volt and 460-volt motors are checked against the 115-volt standard by connecting the motor under test to correct taps on the secondary winding of a suitable type transformer which is part of the testing equipment.

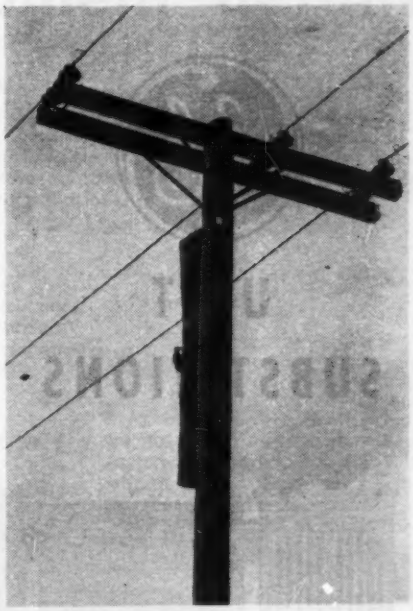
•

Nest Section of Pole Fools Woodpeckers

Woodpecker damage has been a major cause of pole replacement on the Mississippi Power & Light Co. system. At least it was until Division Superintendent V. K. Smith hit upon a deception that has virtually stopped the troubles.

Previous efforts at prevention had consisted of filling the woodpecker holes with concrete, painting white rings around the poles, nailing imitation snakes on the poles. These and sundry other efforts all proved futile.

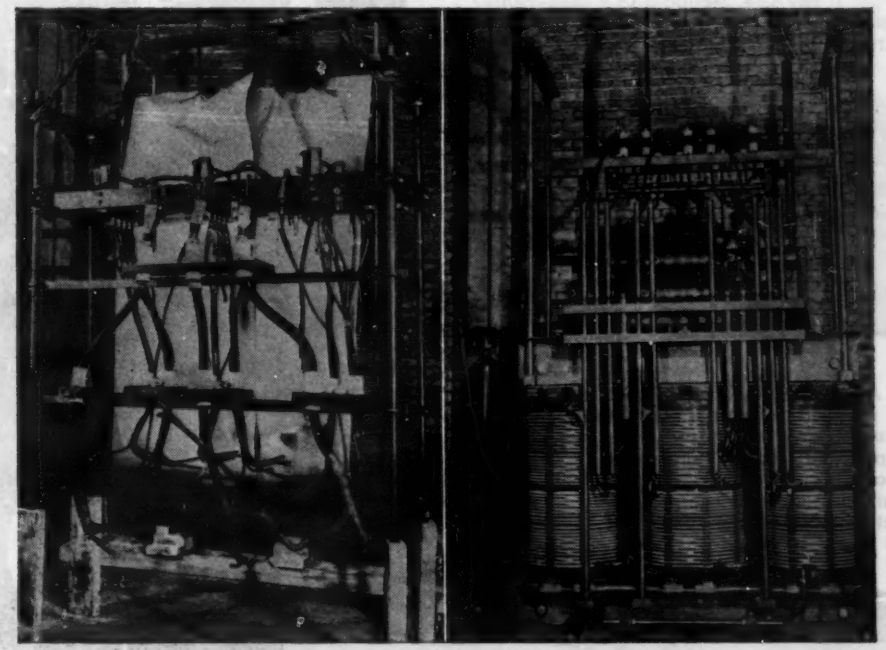
The effective remedy is a matter of saving the holed section of the old pole and bolting it at the top of the new pole. The woodpeckers seem to confine their activities to the old, damaged timber.



TEMPTATION to cling to bored and damaged piece of old pole prompts woodpecker to ignore the new pole

• • •

Home-Made Tap Changer Proved Unsuccessful

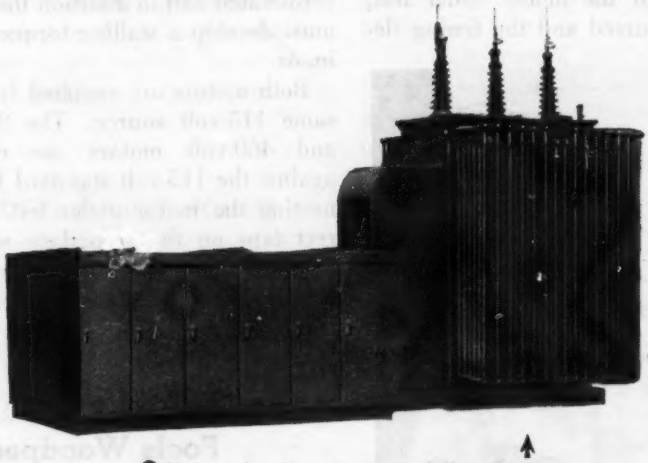


2,500-KVA., 3-PHASE TRANSFORMER (26,400/13,200/2300-volt windings) literally blew up (left) because of a short which developed in the "home-made" tap changer. At the right is the same unit rehabilitated. Leads to the new tap changer, as installed by General Electric Service Shop in New York, are incased in insulating tubing to obtain better clearances and to prevent flexing in event of fault

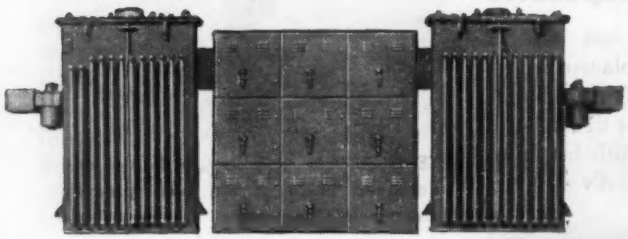
TO LIGHTEN YOUR

standard unit substations eliminate

UNIT SUBSTATIONS



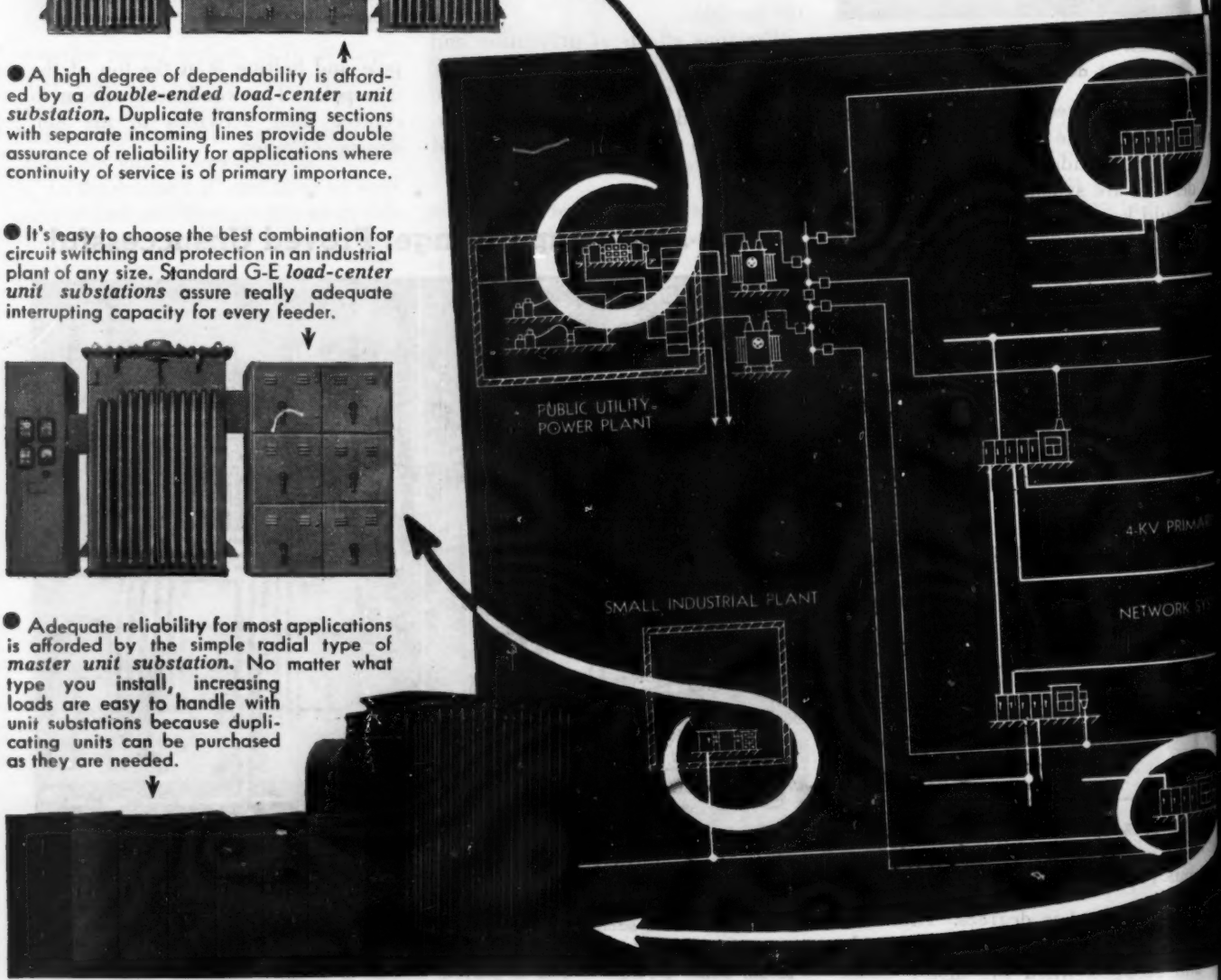
● Shifting loads are easy to follow because these completely enclosed, compact *master unit substations* are relatively easy to move. You avoid the confusion of lost or mislaid parts. Salvage value is 100 per cent.



● A high degree of dependability is afforded by a *double-ended load-center unit substation.* Duplicate transforming sections with separate incoming lines provide double assurance of reliability for applications where continuity of service is of primary importance.

● It's easy to choose the best combination for circuit switching and protection in an industrial plant of any size. Standard G-E *load-center unit substations* assure really adequate interrupting capacity for every feeder.

● Adequate reliability for most applications is afforded by the simple radial type of *master unit substation.* No matter what type you install, increasing loads are easy to handle with unit substations because duplicating units can be purchased as they are needed.

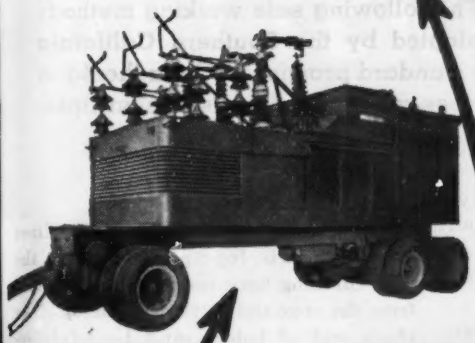


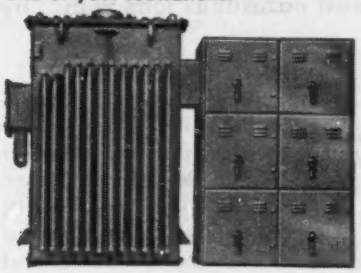
PLANNING LOAD

many worries about equipment details

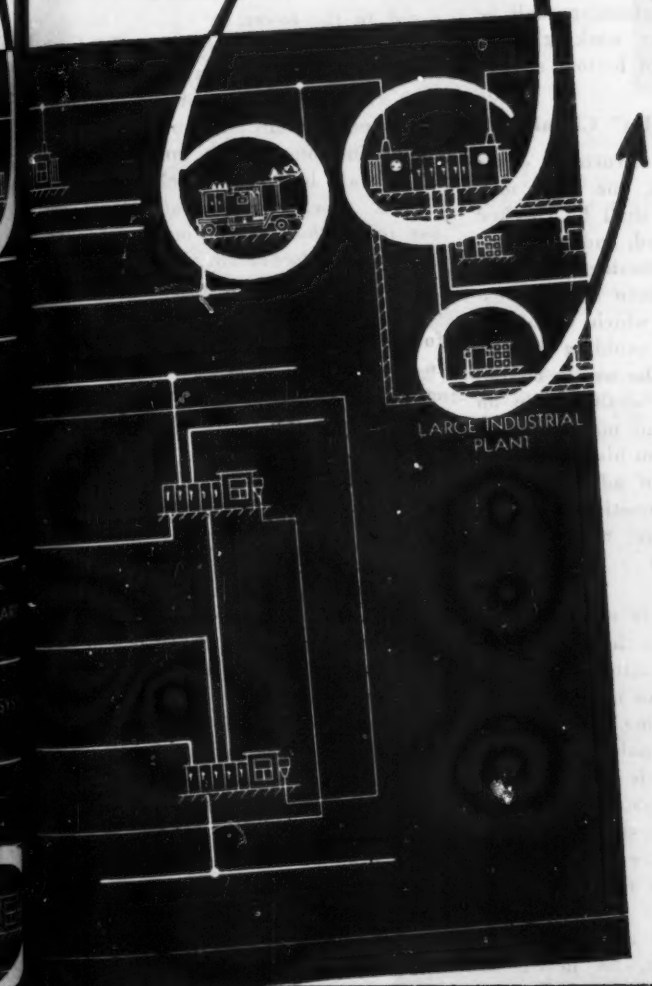
● G-E *master unit substations* are shipped directly to the installation site in completely assembled sections. Installation is always much faster and easier; the installed cost is predictable, and is usually much lower than that of a piecemeal substation.

● Prevention of long-period outages at any point on your system is easy when you have a *mobile unit substation* which has enough capacity to substitute, during an emergency, for any one of your substations.





● Whatever the application may be, there is a repetitively manufactured, standard G-E unit substation which usually can fill the requirements at a saving in cost, compared with the cost of the "special" you may have in mind.



MANY operating companies have found that, by deciding early to use factory-assembled unit substations, they would have more time to study the over-all aspects of their system. This enables them to plan the changes necessary to insure better over-all system operation.

Why you don't have to worry about substation details

Standard G-E unit substations can meet almost any set of requirements. Like building blocks, unit-substation parts can be assembled in hundreds of standard arrangements, each of which is determined by the application and the system requirements. This flexibility of using the standard parts in many different combinations is the reason why unit substations can meet practically any application you may have; why you can feel free to plan over-all system improvements rather than devoting so much time to relatively unimportant details.

A well-planned system, one which has automatic, standard unit substations, means fewer customer outages, better voltage conditions, and a lower equipment-failure rate. The dispersal provided by a number of smaller units (see diagram), compared with one large, central substation, localizes trouble and prevents huge equipment losses as well as large-area outages.

Ask your G-E representative for Bulletin GEA-3800, or for a detailed presentation of our complete line in the light of your specific problem. *General Electric Company, Schenectady 5, N. Y.*

GENERAL ELECTRIC

A GUIDE FOR SAFE WORKING METHODS ON TRANSMISSION LINES

By C. T. MALLOY, General Superintendent, Transmission, Distribution and Communication, Southern California Edison Co. Ltd., Los Angeles, Calif.

Cleaning or testing insulators, working on transmission lines adjacent to energized circuits, and working on transmission lines where it is necessary to climb through the level of other energized circuits are some of the most hazardous jobs with which a transmission line maintenance crew has to contend. The following safe working methods have been adopted by the Southern California Edison Co. as standard practices to be adhered to by all employees working on transmission lines.

Appoint Foreman

1. A foreman shall be appointed to assume the responsibility of a given job. When two or more patrol crews are combined for a job, the Division Superintendent shall appoint one man to act as foreman on the job.

2. Each foreman shall assure himself that each man has the ability and training necessary to perform safely such tasks as may be delegated by the foreman.

3. The foreman shall be held strictly accountable for any infraction of safety rules or practices, and it will be his duty to see that all line construction or rebuild conforms to Standard Construction Methods.

Inspection of Energized Circuits

4. A careful inspection must be made of any energized circuit that is at the same level as the transmission line to be worked on. If there is any indication of faulty insulation or if the pole or hardware is "hot" from leakage, the energized circuit must be taken out of service or repaired before it will be permissible to work on the grounded transmission circuit. If any damage is observed on the energized circuit adjacent to the transmission line, which might indicate that the energized circuit may break down or flash over, repairs must be made on the energized line before any work will be permitted on the grounded transmission line.

Cleaning of Insulators

5. Steel wool shall be carefully balled, allowing no loose strands to hang from the carrying bag which might contact energized conductors while climbing through the lower levels.

6. A careful check must be made to be sure that no loose strands of steel wool are left hanging on insulators or hardware, as a short circuit might result when the line is re-energized.

7. The standard grounding procedure and instructions shall be adhered to.

8. To avoid confusion and misunderstanding, all insulator cleaning shall be started on the top string, working downward to the middle and bottom strings.

Structures with "Hot" Circuits

9. When working on structures carrying energized circuits, the first man climbing the structure shall be checked by a man on the ground, and each man thereafter, before contacting the line, shall check with the man on the next structure and observe which circuit he is working on; thereby avoiding the possibility of getting on the wrong circuit. The man finishing last shall remain on the line until at least one man has made the next climb and taken his position on the same circuit on an adjacent structure. Where it is impracticable to observe the next structure, the workman should be checked by a man on the ground.

10. When the work is confined to a single pole or structure, the man climbing the pole or structure shall be checked by another man on the ground to see that the correct line is approached. The first man up the pole or structure shall, after assuming his working position, check the next man climbing that pole or structure to see that he keeps a safe distance from all energized parts.

11. When it becomes necessary for a man climbing a pole to stop at a crossarm to rest, he should remain close to the pole. If, however, he desires to move away from the pole he shall move only in the direction of the dead line, and then only after he has checked with the man checking him.

220-kv. Lines

12. When working on 220-kv. lines equipped with fog-type insulators, the man climbing must use a ladder to climb from the crossarm to the conductor. The tower end of ladder must be safely secured to the tower.

13. When working on multi-circuit structures, the workman must approach each circuit from the catwalk, carefully observing the circuit name, and upon completing one circuit must return to the catwalk before approaching the next circuit. *Moving horizontally from one bay to another, except on the catwalk, is positively forbidden.*

14. On multi-circuit structures the circuit names must be legible, and where found to be otherwise must be reported to the Division Superintendent. The circuit names must be stenciled on the steel, in each bay, so that the circuit can be readily identified.

15. On pole lines, names of circuits shall be installed on each corner pole.

New Employee

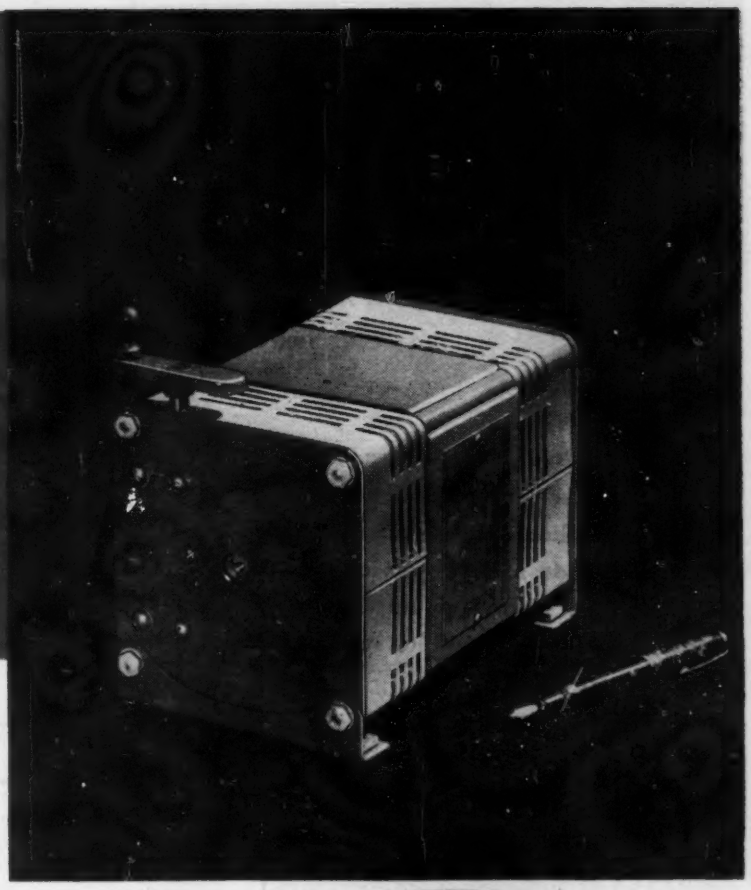
16. When a new man is added to your crew he should be teamed with an experienced man who will watch him carefully until he is familiar with the work and the locality.

17. Gang competition and rawhiding will not be permitted as it results in inferior workmanship and encourages disrespect of safety rules.

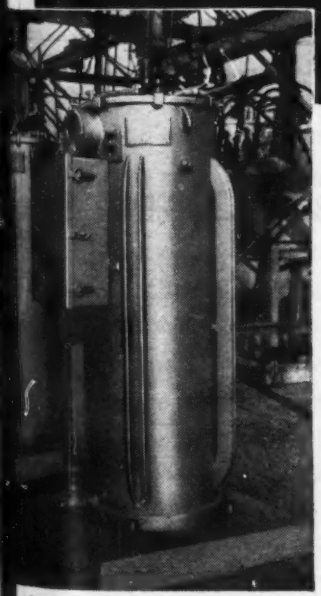
18. Too much care cannot be exercised with spurs when climbing termite-infested, woodpecker-eaten or rotted poles. Such poles, if frequently climbed, should be stepped. When they are not stepped, do not hesitate to use your safety strap while climbing.

19. When Meggering insulators, be careful of the Megger-cord and keep it clear of bare and energized lines.

he RIGHT PLACE Does the Job BETTER

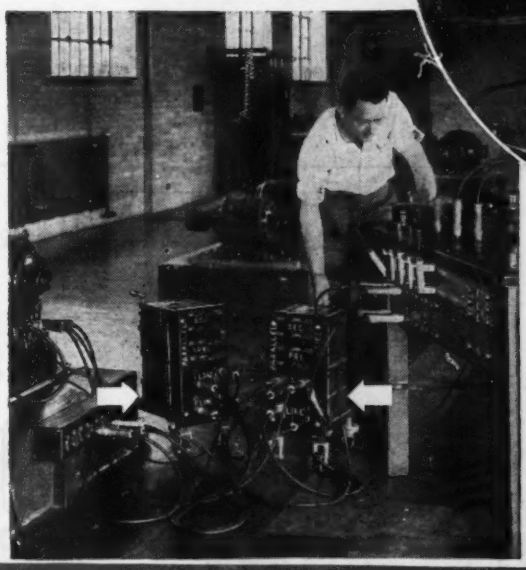


SMALL DRY-TYPE REGULATORS—For 120- and 240-volt circuits. 10% raise and lower or 100% raise and lower regulation. Up to 600 va, single-phase. 10% ratings available for automatic operation.



VOLTAGE STABILIZERS—Automatically provide a constant 115- or 230-volt supply to a given load, on circuits varying from 95 to 130 or 190 to 260 volts. Ratings from 50- to 5000-va output.

VARIABLE-VOLTAGE AUTOTRANSFORMERS — Provide smooth, adjustable control of voltage, current, light, temperature, power, and speed at a turn of the dial. Ratings from 243- to 810-va output for 115- and 230-volt circuits.



INDUCTION REGULATORS (IRS—oil-type or Pyranol for indoor or outdoor use)—Provide 10% regulation raise and lower on 2400-, 4800-, and 6900-volt feeders. 12 to 120 kva, single-phase. Also available three-phase.

DRY-TYPE REGULATORS (AIRS)—For secondary circuits. *Automatic type:* Provides 10% regulation raise and lower. *Remote-motor or hand-operated:* 100% raise and lower. Up to 12 kva, 600 volts, single-phase. Also available three-phase.

GENERAL ELECTRIC

HOW TO USE DRY-TYPE TRANSFORMERS AS AUTOTRANSFORMERS TO STEP UP VOLTAGE ON SINGLE-PHASE CIRCUITS

By C. E. BURKE and H. K. PRITCHARD, Specialty Transformer Section
Fort Wayne (Ind.) Works, General Electric Co.

Single-phase transformers of standard service voltage ratings can be applied as autotransformers to provide step-up service. It is apparent that the maximum saving is available as the voltage ratio approaches unity.

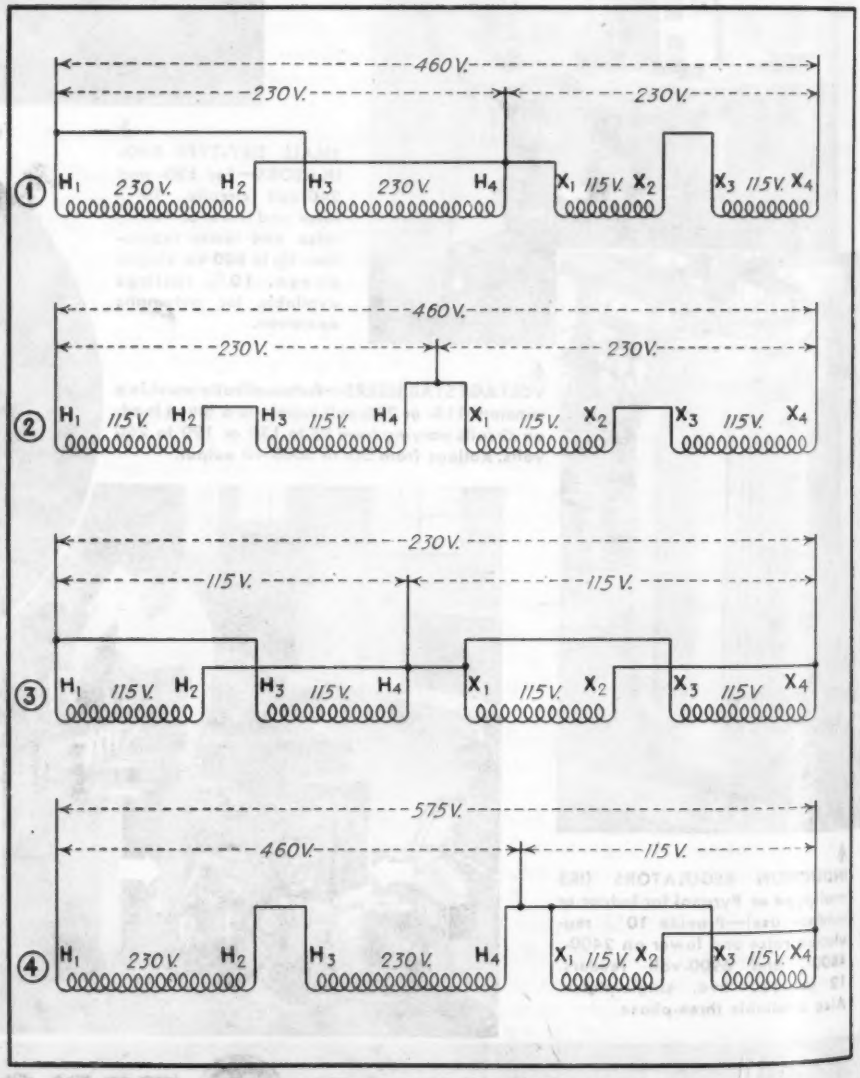
Items to be borne in mind. In some territories local codes prohibit the use of autotransformers, and for some applications it is necessary that the load circuit be completely isolated from the supply circuit. Under such conditions transformers must be used. Autotransformers are not usually recommended for stepdown service because of the danger of destroying a device by having a voltage greater than its rated voltage accidentally impressed upon it.

Table provides data on standard dry-type, low-voltage, single-phase transformers used as autotransformers. For the step-up service the ratio of low voltage to high voltage in the first three cases is 0.5 and, therefore, the amount of kva. transformed is (1—0.5 = 0.5) 50 percent of the total kva.; in the last case the ratio is 0.8 and the kva. transformed is (1—0.8 = 0.2) 20 percent. Output kva. to the load is then 200 percent of the transformer nameplate rating in the first three cases and output is 500 percent for the fourth case.

For the accompanying diagrams, lead markings indicate relative directions in the windings. Thus, if H_1 is the start of one high-voltage winding, H_2 is the finish. H_3 is the start and H_4 is the finish of the other high-voltage winding. X_1 is then the start of the first low-voltage winding and X_3 is the start of the other low-voltage winding. The two high-voltage windings are connected in multiple by connecting H_1 to H_3 and H_2 to H_4. The two low-voltage windings are connected in series by connecting X_2 to X_3. The two windings thus formed are connected in series aiding by connecting H_4 to X_1, and the autotransformer is complete.

Data on Single-Phase Transformers Applied as Autotransformers

Step-Up Service, Volts	Voltage Ratio	Use Fig. No.	Transformer Rating, Volts		Kva. Transformed, Percent	Output Kva., Percent
			Primary	Secondary		
230 to 460	0.5	1	230/460	115/230	50	200
230 to 460	0.5	2	115/230	115/230	50	200
115 to 230	0.5	3	115/230	115/230	50	200
460 to 575	0.8	4	230/460	115/230	20	500



STANDARD TRANSFORMERS connected as autotransformers

Because power plants need CONDENSER TUBE PLATES

Revere Condenser Tubes are preferred because of their long, satisfactory service, and so are Revere Plates, for the same reason. The two make a perfect combination, both being made with the same high skill, to the same standards.

Our long experience makes it possible to deliver to you plates that are dense, free from blow holes and surface imperfections, characterized by flatness, accuracy of gauge, machinability and resistance to corrosion.

Revere Condenser Tube Plates are available in squares, rectangles, circles, half-circles, segments, patterns, up to 120 inches. Finished weight, up to approximately 11,000 pounds. Metals include Admiralty Metal, Muntz Metal, Naval Brass and Cupro-Nickel, where authorized. Revere Condenser Tubes are available in these, and also in Revalon (aluminum brass). Other Revere products for power plants include copper tube and pipe, Red-brass pipe, copper bus bar, Herculoy (silicon-copper alloy) in plate, sheet, strip, rod, forgings. For advice in the selection of the proper non-ferrous alloys for your purposes, write the Revere Executive Offices.

Pouring a 12,000-pound cake of Revere Cupro-Nickel for a Navy Condenser Tube Plate.

REVERE

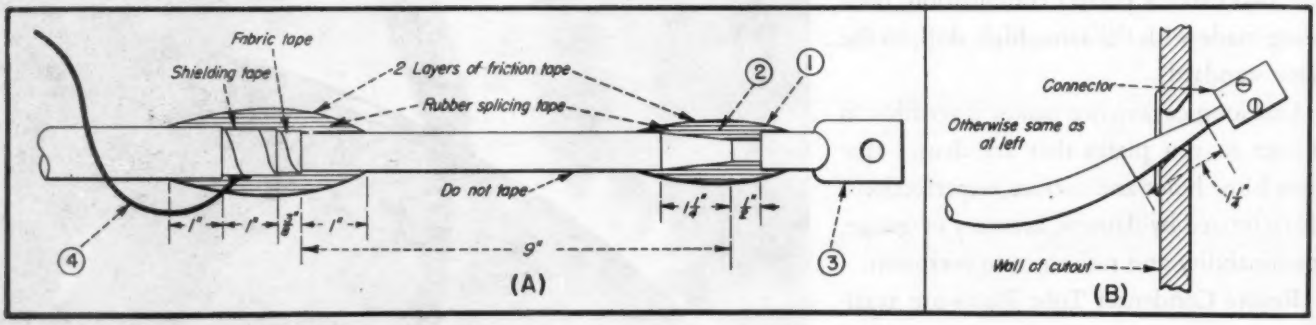
COPPER AND BRASS INCORPORATED

Founded by Paul Revere in 1801

Executive Offices: 230 Park Ave., New York 17, N.Y.

SEQUENCE OF OPERATING DETAILS IN EFFECTING A TERMINATION OF A 2.4-KV. AERIAL CABLE

Outline for termination of a single-conductor, shielded, rubber and braid, 2400-volt, aerial cable in a lug and in a cutout, includes list of material required. This step-by-step procedure is adapted from the construction standards of The United Illuminating Co., New Haven, Conn.



TERMINATION of single-conductor aerial cable in lug (left) and in cutout (right)

Steps in making an aerial cable terminal are as follows:

1—Installation of Lug

Remove the insulation and clean each conductor for a distance of ¼ in. more than the depth of the lug.

Tin the conductor and copper lug and sweat into place. Remove any rough solder points.

Omit lug if cable is terminated in a cutout (B).

2—Preparation of Insulation

Remove braid for 10⅝ in., shielding tape for 9⅝ in. and cable tape to within ⅜ in. of this point.

Smooth and solder ends of shielding tape together.

Solder a No. 8 stranded ground wire to the shielding tape of sufficient length to tap on the messenger.

Pencil the insulation for 1¼ in. leaving a ½-in. space between lug and insulation. Smooth pencil.

3—Insulation At Lug

Clean insulation and lug. Coat insulation and body of lug with cement, starting ½ in. beyond the pencil. Allow cement to dry.

Fill in the pencil with one-half lapped insulating tape stretched to three-fourth of its original width, and extend back over insulation for ½ in. and over body of lug. Roll each layer smooth with a roller.

Material List

Item	Quantity		Description
	Fig. A	Fig. B	
1	0.5 lb.	0.25 lb.	Friction tape
2	1.5 lb.	1 lb.	Rubber Compound
3	1		Copper lug (†)
4	(*)	(*)	No. 8 Stranded wire
5	0.5 lb.	0.25 lb.	Solder
6	(*)	(*)	Cement
7	(*)	(*)	Insulating Paint
8	1	1	Connector (†)

* Quantity as required.
† Size as required.

4—Insulation Over Ground Connection

Apply cement for 1 in. beyond the cable tape and allow to dry.

Cover end of shielding tape and build it up to a thickness equal to the insulation thickness and extending for 1 in. beyond the tape and back over the braid.

5—Finish

Apply friction tape over all the insulating tape extending back over the end of the braid for 1 in. Do not tape over intervening 6¾ in. of factory insulation.

Paint the entire length of insulation and friction tape with special insulating paint. Omit insulating paint over factory insulation unless recommended by the manufacturer.

Eliminates drilling and tapping studs—

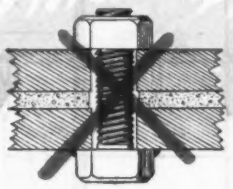
NELSON ARC STUD WELDING!

Automatic stud welding saves time and material. It eliminates the costly operations of drilling, tapping, and hand welding bolts for studs. With the Nelson Stud Welder "flux-filled" studs are *automatically* end-welded to metal instantly. Uniform welds with full-fillet result every time.

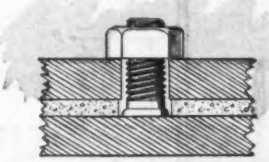
All standard stud diameters from 3/16" to 3/4" are manufactured—all may be welded with the same stud welding unit. A standard welding generator is used. The equipment is portable and may be used effectively in any position or operated as a production unit from a fixed jig. (Multi-gun units are available for special production jobs.) More than 700 industrial plants and shipyards are using thousands of stud welders in time-saving applications. No previous welding experience is necessary for operators.

The Nelson Stud Welder welding through locating template.

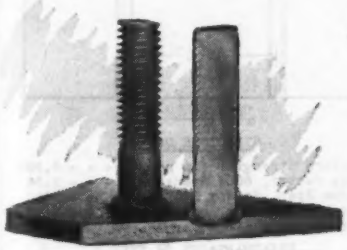
STUD WELDED IN ½ SECOND!



Eliminates hand welding to secure bolt or stud. Unsightly bolt head is omitted.



Instead stud is welded to metal—equal in strength yet saves three or more operations!



Cutaway view of stud weld after etching with Nital.

Complete fusion of stud to metal is obtained—a deep penetration. Fillet not only on outer surface of stud but complete binding through base. Automatic timing control and uniform heat produces these results—consistently and quickly.

For complete details, prices and catalog write:

NELSON SPECIALTY WELDING EQUIPMENT CORP.
Dept. EW, 440 Peralta Avenue
San Leandro, California

Eastern Representative: Camden Stud Welding Corp. Dept. 122, 1416 South Sixth Street, Camden, N.J.

Compare Designs of H-Frame Structures*

RALPH G. YERK
Chief Engineer, Hughes Brothers, Seward, Nebraska

Selection of the design of tangent structure for a transmission line must be with reference to the overall cost of the line. This will include analysis of the profile, conductor, right of way and local conditions affecting span lengths.

In general, however, of the three types of structures compared herewith, type C will rarely produce the most economical line. Span length will be limited, requiring more structures and associated parts; the deflection and earth pressure will be excessive.

The simple installation of the "X" brace, as in type B will eliminate deflection, reduce earth pressure, permit the use of smaller poles and result in longer spans and greater safety factor.

Type A design, however, will usually result in the safest, strongest and most economical long-span, high-voltage construction. The knee braces or inverted crossarm braces permit the pole tops to act as guided cantilevers by introducing a point of inflection between the crossarm and the top of the braces. Without knee braces, the poles above the braces act as simple cantilevers.

Guy wires will not substitute as internal bracing for "X" or "K" braces. The tension guy only is effective and the load is, therefore, all on one pole.

Span Length

Considered from the cost standpoint the cheapest tangent structure that considers only a normal level span does not usually result in the most economical transmission line. Two single poles and a single-membered crossarm obviously are less expensive than two poles with a factory-assembled double arm and "X" and "K" braces. The economy in using the more expensive structure is that the advantage of longer spans can only be realized with well-braced structures. It is necessary to eliminate only a few structures in the entire line to show a saving in the overall cost of the line.

Not only can properly braced H-frame construction be built at a saving over unbraced or improperly braced H-frame line but it will also result in greater strength and less maintenance. Excessive deflection and earth pressure in unbraced structures requires constant maintenance to keep the structures in line.

* Based on paper "Modern Transmission Construction" presented recently by the author before Electric Section, Wisconsin Utilities Assn., Milwaukee, Wis.

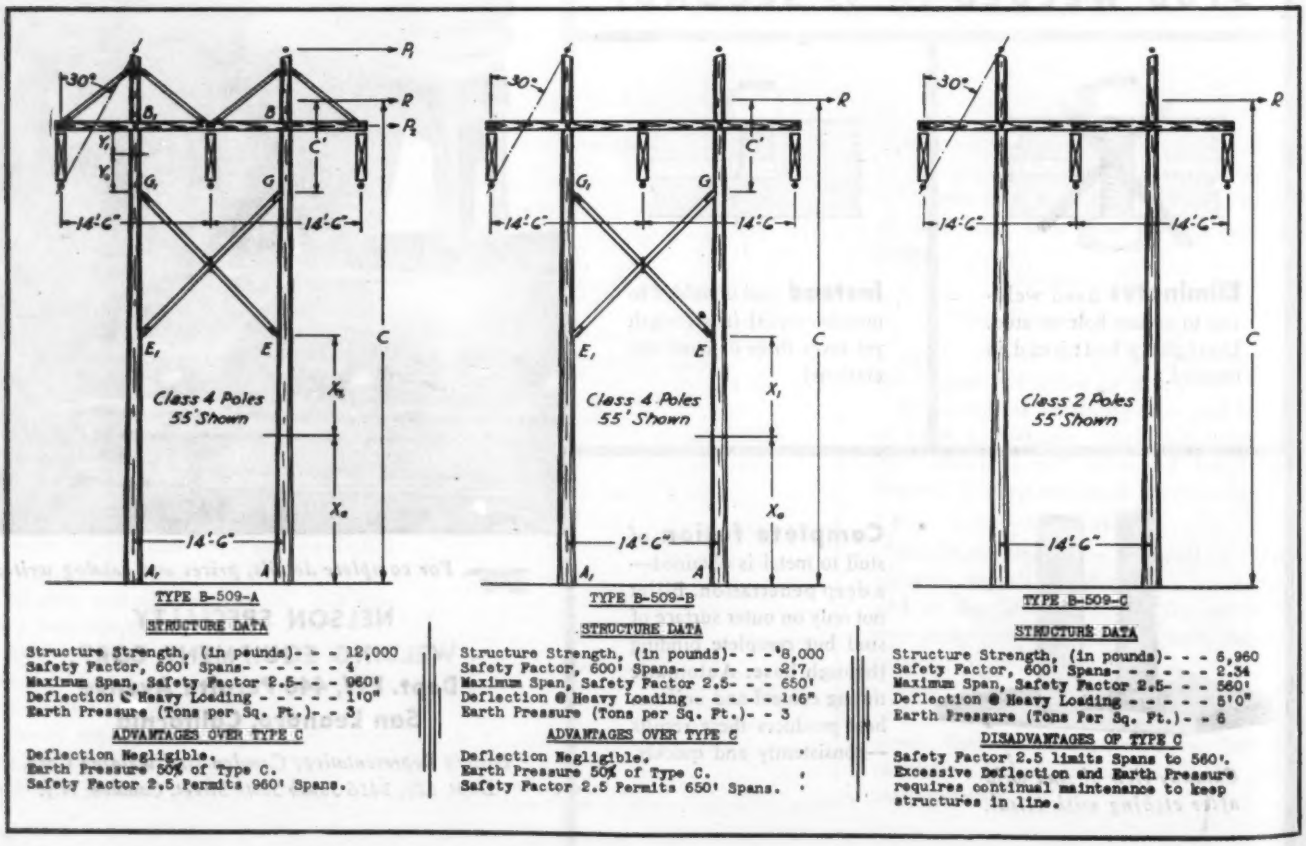
•

Grind Flash Barriers to Any Radius Desired

A. D. THERRIEN
Northern Indiana Public Service Co. Hammond, Ind.

Maintenance of the smallest possible annular clearance between the commutator of a synchronous converter and its associated flash barrier is essential if ionized gases are to be kept from passing from one brush holder to the next, leading to destructive flashovers, during short circuit.

When received from the manufacturer, flash barriers fit their commutators properly but after a number of years of service, if the commutator diameter has been reduced by brush wear, stoning or turning in a lathe, they will no longer conform closely enough to the curvature of the com-


30°
14'-6"
Class 4 Poles
55' Shown
TYPE B-509-A
STRUCTURE DATA
Structure Strength, (in pounds)- - - 12,000
Safety Factor, 600' Spans- - - - - - 4
Maximum Span, Safety Factor 2.5- - - 960'
Deflection @ Heavy Loading - - - - - 1'0"
Earth Pressure (Tons per Sq. Ft.)- - 3
ADVANTAGES OVER TYPE C
Deflection Negligible.
Earth Pressure 50% of Type C.
Safety Factor 2.5 Permits 960' Spans.
Class 4 Poles
55' Shown
TYPE B-509-B
STRUCTURE DATA
Structure Strength, (in pounds)- - - 8,000
Safety Factor, 600' Spans- - - - - 2.7
Maximum Span, Safety Factor 2.5- - - 650'
Deflection @ Heavy Loading - - - - - 1'6"
Earth Pressure (Tons per Sq. Ft.)- - 3
ADVANTAGES OVER TYPE C
Deflection Negligible.
Earth Pressure 50% of Type C.
Safety Factor 2.5 Permits 650' Spans.
Class 2 Poles
55' Shown
TYPE B-509-C
STRUCTURE DATA
Structure Strength, (in pounds)- - - 6,960
Safety Factor, 600' Spans- - - - - - 2.34
Maximum Span, Safety Factor 2.5- - - 560'
Deflection @ Heavy Loading - - - - - 5'0"
Earth Pressure (Tons Per Sq. Ft.)- - 6
DISADVANTAGES OF TYPE C
Safety Factor 2.5 limits Spans to 560'.
Excessive Deflection and Earth Pressure requires continual maintenance to keep structures in line.

DESIGN COMPARISON OF THREE TYPES of 132-kv. H-frame structures reveals advantages favoring "X" and "K" bracing

GENERATOR DESIGN

FOR

New Bedford and *Staten Island*

Four new steam generators each designed for 120,000 lb. per hour at 950 lb. per sq. in. and 910° F. final steam temperature.

STEAM GENERATION

Large Central Station steam generator design applied to medium capacity units.

High furnace—long flame travel—cool exit gases—minimum tendency to slag. Control of final steam temperature from 60 per cent to full load.

Ample circulation head.

Exceptional accessibility of pressure parts.

PULVERIZED FUEL FIRING

Sustained efficiency due to fine pulverization.

Ability to handle low grade, wet coal.

Surplus pulverized fuel always available for sudden increases in load or temporary plugging of coal supply.

FOSTER WHEELER CORPORATION

165 BROADWAY • NEW YORK 6, N. Y.

WHEELER FW

Insure STEADY PERFORMANCE

PROTECT WITH DELTABESTON CABLES

A. Copper B. Felted Asbestos C. Varnished Cambric
D. Belt Insulation E. Lead Sheath F. Jute Bedding
G. Interlocking Armor

One of the safest ways to insure steady performance in circuits that run around boiler rooms, steam tunnels, furnaces and other severe operating places is to protect with G-E Deltabeston Asbestos-insulated Cables. Unexpected cable failures in power, lighting or control circuits can make your plant lose production and profits. Why take unnecessary risks? Make an inspection trip around your power plant, check the torrid zones where heat, moisture and corrosive vapors are busy at their destructive work and rewire with Deltabeston Asbestos-insulated Cables.

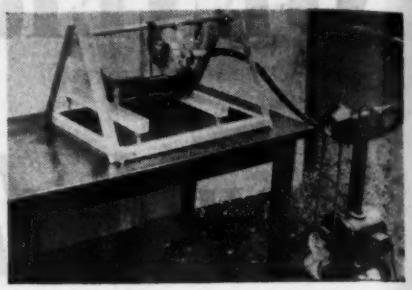
The Deltabeston product shown here is a three-conductor power cable with lead sheath, jute bedding and interlocking armor. It was designed for a central station to handle high current densities, during peak load periods. It has fine resistance to high ambient temperatures. It's flame-proof and physically tough. The armor takes the place of rigid conduit and gives the cable the same protection. Construction without interlocking armor or jute bedding can be supplied. Also available with asbestos braid instead of lead sheath. There's a Deltabeston Cable for every installation where heat, flame, moisture, oil, grease and corrosive vapors are a problem.

For additional information write to Section Y751-9, Appliance and Merchandise Dept., General Electric Co., Bridgeport, Conn. Deltabeston Cables are distributed nationally by Graybar Electric Co., G-E Supply Corp., and other G-E Merchandise Distributors.

Buy War Bonds and Keep Them

GENERAL ELECTRIC

mutator to be effective. They then must be ground to fit the reduced commutator diameter so that the commutator and barrier surfaces are again close-fitting concentric cylinders.

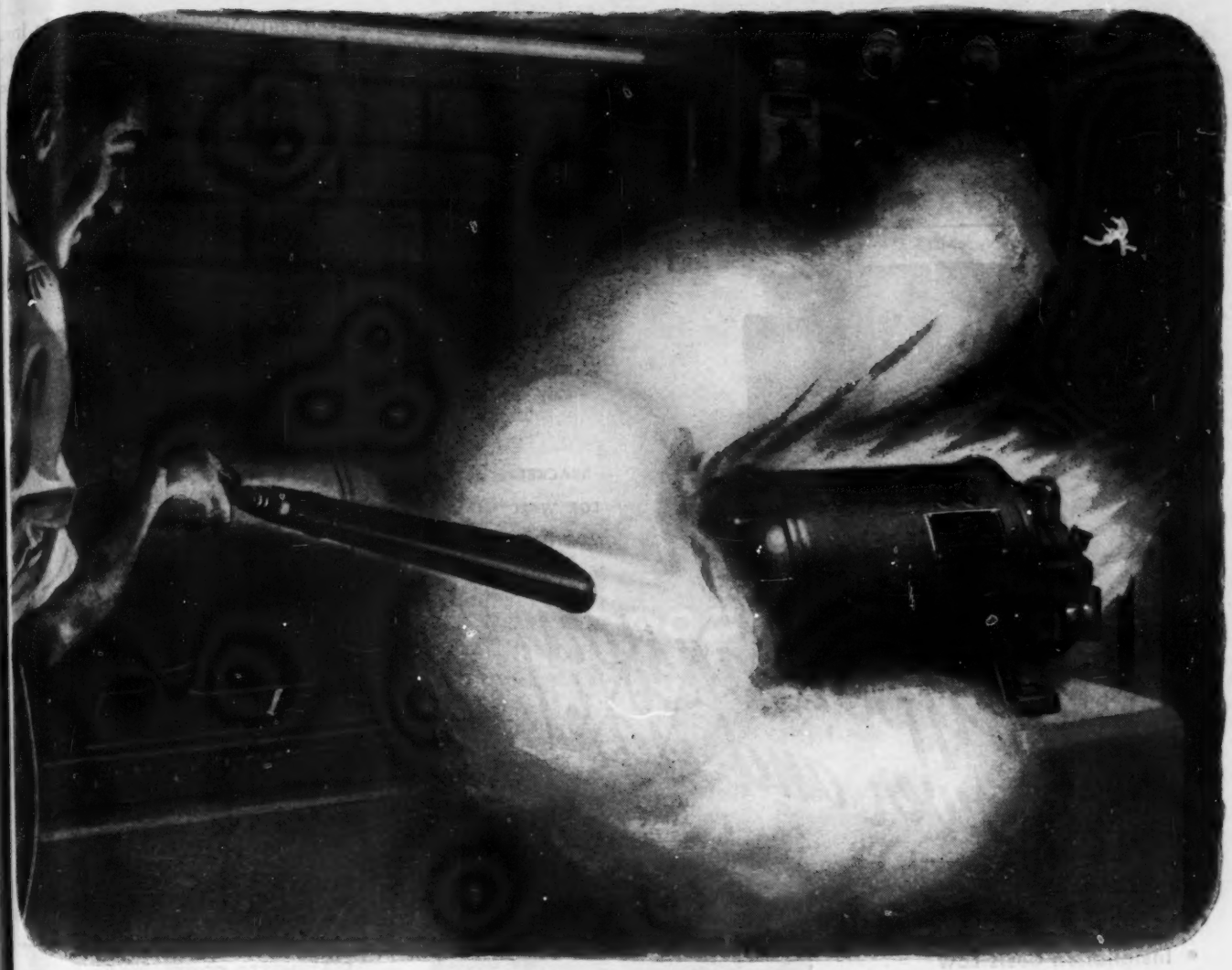


EMERY WHEEL suspended from arbor can be adjusted to grind flash barriers to any desired radius. Note housing around emery wheel for attaching vacuum cleaner suction hose to remove dust during grinding operation

If this grinding is done by hand it is tedious, difficult and inaccurate at best. The Northern Indiana Public Service Co. has designed and built the illustrated grinding device for re-shaping flash barriers which makes it possible to fit barriers to the curvature of their respective commutators within very close limits, thus assuring efficient operation.

The device used employs an emery wheel, driven by an electric motor through a flexible shaft, for the grinding. This wheel is mounted, by means of a turn buckle and sleeve arrangement, to swing in an arc of adjustable radius from a horizontal

FLASH BARRIERS in place around commutator of synchronous converter. Clearance between barrier and commutator should be a minimum to keep down flashovers



Deadly to fire . . . and only to fire!

It's sudden death to flames, of course — in electrical apparatus or flammable liquids — but that's just *one* of the outstanding advantages of Kidde equipment.

Equally important: dry, inert carbon dioxide gas — the fast, sure extinguishing agent used in Kidde equipment — is *completely harmless* to machines and materials.

Carbon dioxide gas *cannot* corrode metallic parts, or water-soak insulation. It's a non-conductor of electricity . . . there's no danger of short-circuits, or of shock to the operator. It will not contaminate or dilute flammable liquids. And it leaves no after-fire mess to be cleaned up.

Kidde portable extinguishers for small, isolated blazes in electrical equipment and flammable liquids; wheeled units and built-in systems for major hazards — all are deadly to fire, and *only* to fire. The Kidde line includes the *right* kind of protection for every tough-fire hazard in the accompanying list...ask a Kidde representative for full information.

* * *

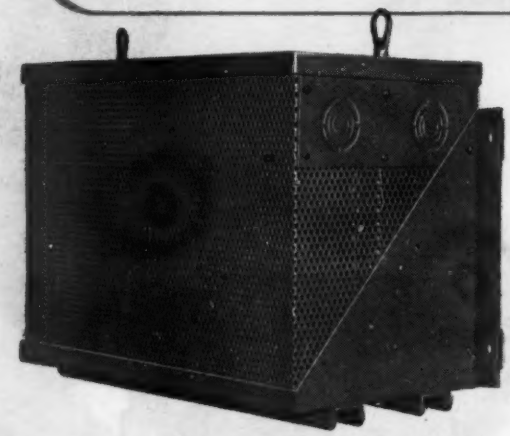
KIDDE KILLS TOUGH FIRES *in Generators, Motors, Condensers, Transformers, Switchgear, Lightning Arresters, Rectifiers, Regulators, Flammable Liquid Storage, and Oil Lubricant Recirculation.*

The word "Kidde" and the Kidde seal are trade-marks of Walter Kidde & Company, Inc.

Walter Kidde & Company, Inc. • 140 Cedar Street • New York 6, N. Y.

DAVIS

TRANSFORMERS



¾" CONDUIT IN LEFT AND OUT OF RIGHT SIDE.

BRACKET FOR WALL MOUNTING

"DAVIS" DRY TYPE
3 KVA, 3 PHASE, 60 CYCLE
208Y/120-115

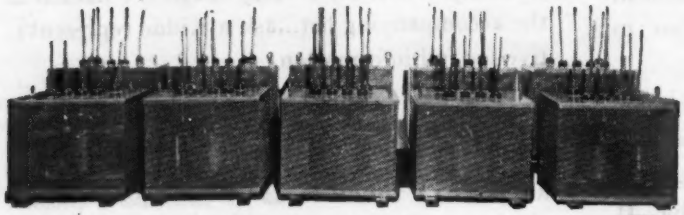
Dry Type Transformers for Power and Lighting

- Fire Hazards Eliminated
- Installation Costs Low
- Light Weight Easily Handled
- Vaults not Required
- May be Located Adjacent to the Load Center, Permitting Short Cable Runs.

"DAVIS" DRY TYPE, 25 KVA 550-110/220 FOR WALL MOUNTING, WITH CONDUIT NIPPLE CONNECTIONS IN COVER

DAVIS DRY TYPE TRANSFORMERS

READY FOR SHIPMENT FOR ALL PURPOSES



DAVIS TRANSFORMER COMPANY

DAVIS TRANSFORMER CO.

Phone 177 CONCORD, N. H.

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION NEMA MEMBER

and

STOCKWELL TRANSFORMER CORP.

CONCORD, N. H.—Phone 177 AKRON, OHIO—Phone Jefferson 4179

Manufacturers of Oil Cooled, Dry Type, Power and Distribution Transformers
Also All Types of Specialty Transformers Regardless of Size

arbor supported from an angle iron framework. Flash barriers to be grounded are bolted to an adjustable jig also part of the radius.

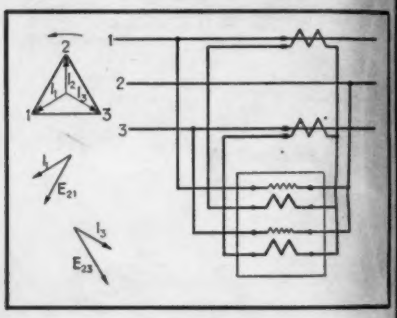
Development of this barrier grinder was instrumental in reducing the number of flashovers on system synchronous converters from 108 in 1942 to 36 in 1943 and 4 in 1944.

•

Correct Meter Readings for Phase Angle Errors

C. E. WENTZ
Transformer Design Engineer, Westinghouse Electric Corp., Sharon, Pa.

A mathematical explanation is provided to correct meter reading for phase angle errors in instrument transformers. It is applicable where both single-phase and polyphase wattmeters are involved.



WATTMETER CONNECTIONS. Diagram from *Electrical Metermen's Handbook*, 5th edition, 1940, Fig. 42, page 34. Current vectors shown are at 100 percent power factor

Single Phase — The effect of phase angle in instrument transformers on the reading of a single-phase wattmeter is well understood. A positive phase angle of B deg. in a current transformer changes the apparent power factor at the meter from the true value cos θ to cos $(\theta - B)$; the meter reading must be corrected by the factor K_e, that is, multiplying by:

$$K_e = \frac{\cos\theta}{\cos(\theta - B)}$$

$$= \frac{\cos\theta}{\cos\theta\cos B + \sin\theta\sin B}$$

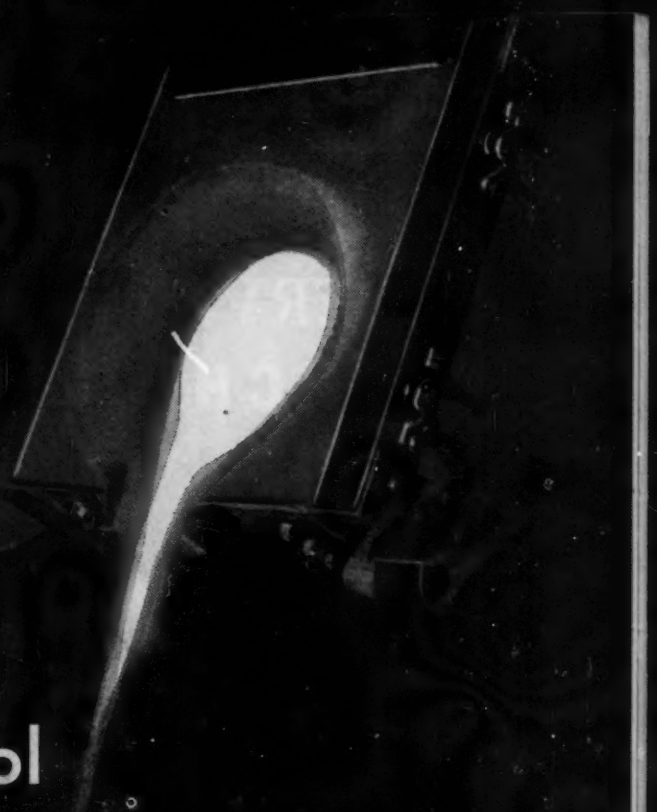
As cos B is substantially unity (B rarely exceeds 1 deg.) and dividing through by cos θ;

$$K_e = \frac{1}{1 + \tan\theta\tan B}$$

Polyphase—Three-phase, 3-wire metering with two wattmeters; see

The Secret of Nichrome* Superiority

Metallurgical Control *from* Furnace *to* Spool



To produce genuine Nichrome takes more than the combining of the two metals Nickel and Chromium. It requires highly specialized techniques to make this superior heat and oxidation resisting alloy.

Step-by-step through every stage of manufacture, from the first melting of the metals to the final spooling of the finished wire, precise metallurgical checks and controls operate to assure the peerless quality of Nichrome.

These exclusive Driver-Harris quality controls represent 45 years of continuous alloy research. No wonder, therefore, that Nichrome is the time-tested standard by which other electrical resistance alloys are measured. Although there are many excellent nickel chromium combinations there is *only one Nichrome* . . . and it is made *only* by Driver-Harris.

For full technical information regarding D-H Nichrome write for Data Book R-42.

NICHROME is made *only* by

D/H

SPECIAL PURPOSE ALLOYS SINCE 1920

*Trade Mark Reg. U. S. Pat. Off.

ARMY NAVY

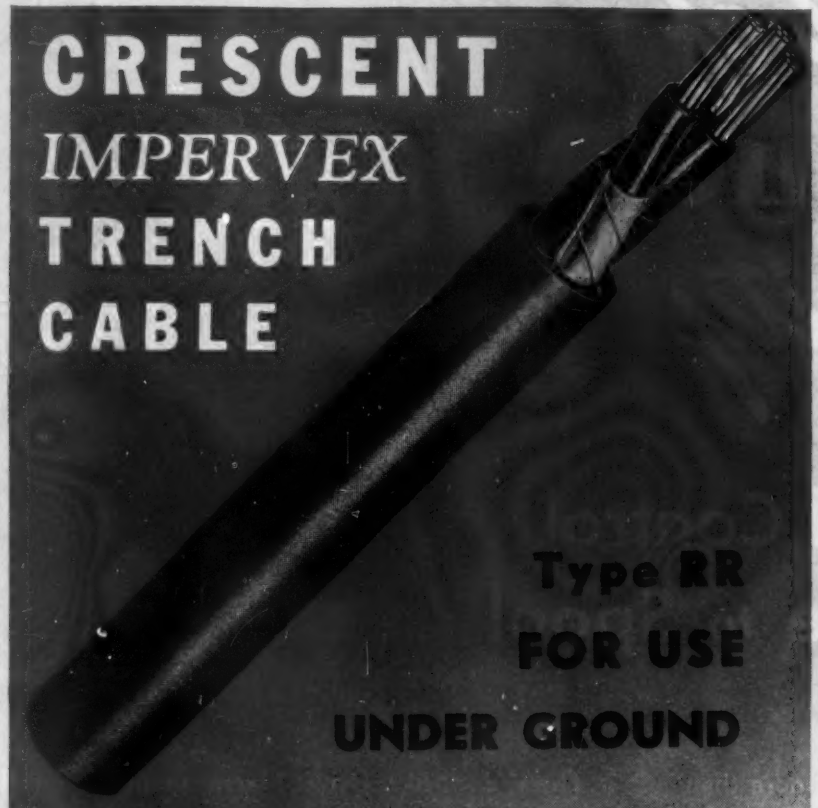
Driver-Harris COMPANY

HARRISON, N. J.

Branches: Chicago • Detroit • Cleveland
Los Angeles • San Francisco • Seattle

● RUBBER POWER CABLES ● VARNISHED CAMBRIC CABLES ● PERMACORD ● LEAD-ENCASED AND PARKWAY CABLES ● SYNTHOL WIRES ● WELDING CABLES ● SHIPBOARD CABLES ● IMPERIAL NEOPRENE JACKETED PORTABLE CABLES ● ARMORED CABLE ● CRESFLEX NON-METALLIC SHEATHED CABLE ● SERVICE ENTRANCE CABLE ● BUILDING WIRE

CRESCENT
IMPERVEX
TRENCH
CABLE



Type RR
FOR USE
UNDER GROUND

Suitable for installations in ducts or in direct contact with the earth. The copper conductors are insulated with IMPERVEX moisture resisting Type RW insulation and are permanently protected by a heavy, tough Neoprene jacket that is sunproof, flameproof, and highly resistant to oil, acids, alkali and water. It is approved by Underwriters' Laboratories as Type USE-Underground Service Entrance Cable.

CRESCENT IMPERVEX TRENCH CABLE—Type RR—provides a low cost, easily installed, permanent, underground circuit between power line and buildings or between buildings of mines, institutions, farms, and estates, etc. Furnished in sizes #14 to #4/0 A.W.G., two, three and four conductors. Our Engineering Department will be glad to recommend a cable best suited to your needs.

CRESCENT INSULATED WIRE & CABLE CO.
TRENTON, N. J.

CRESCENT
WIRE & CABLE

illustration. The overall effect of phase angle on this metering connection is not evident at first glance. It will be proved, however, that the overall correction factor is exactly the same as given above for single-phase metering. The reason for this seems to be that although the percentage error in the one wattmeter which works at low power factor at the meter will be greater than the error in the other wattmeter, the power measured by the low power factor meter will be less, and the total error in watts turns out to be the value given by the simple single-phase formula. This may be proved mathematically as follows:

$$\text{True Power} = E_{2\text{-}1} I_1 \cos(\theta + 30) + E_{2\text{-}3} I_3 \cos(\theta - 30)$$

Again, a positive phase angle of B changes the apparent power factor at the meters, so that the meters read:

$$\text{Meter Power} = E_{2\text{-}1} I_1 \cos(\theta + 30 - B) + E_{2\text{-}3} I_3 \cos(\theta - 30 - B)$$

For balanced load $E_{2\text{-}1} I_1 = E_{2\text{-}3} I_3$. The correction factor (K_c) by which the meter power must be multiplied to get true power is:

$$K_c = \frac{\cos(\theta + 30) + \cos(\theta - 30)}{\cos(\theta + 30 - B) + \cos(\theta - 30 - B)}$$

$$= \frac{\cos(\theta + 30) + \cos(\theta - 30)}{\cos(\theta + 30)\cos B + \sin(\theta + 30)\sin B + \cos(\theta - 30)\cos B + \sin(\theta - 30)\sin B}$$

Again, if $\cos B = 1$, and dividing through by $\cos(\theta + 30) + \cos(\theta - 30)$

$$K_c = \frac{1}{1 + \tan B \tan \theta}$$

If the phases are badly unbalanced this relation will not hold exactly. As the unbalance in loading changes from day to day and hour to hour, these small errors in the correction factor will usually be negligible.

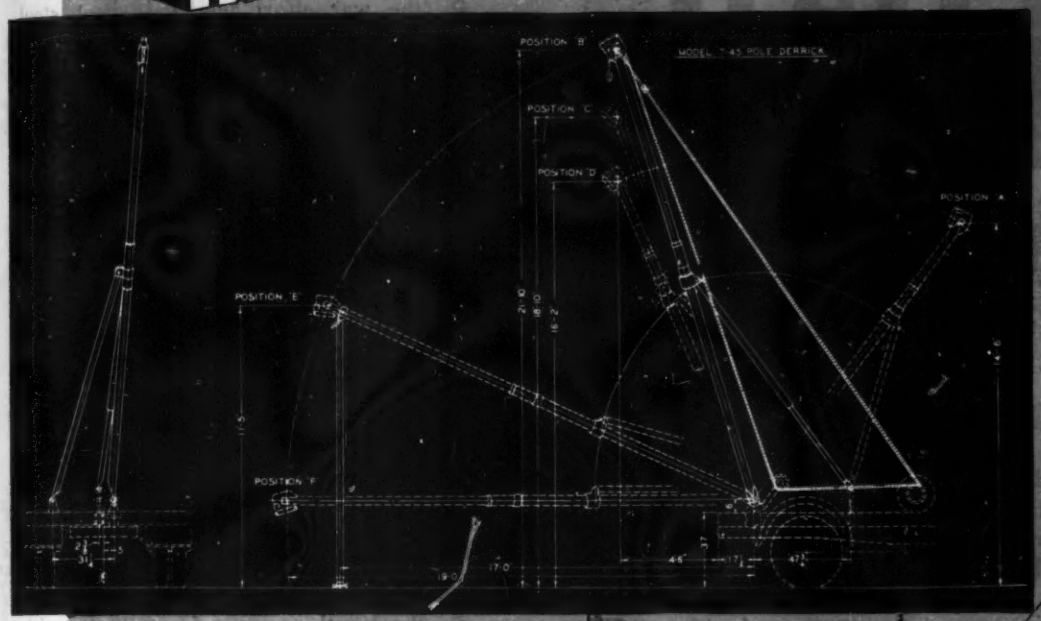
The problem has been solved as if only current transformers and current transformer errors were present, but it is obvious that the same reasoning would apply, and the same conclusions reached if voltage transformers were used.

(Republication rights are reserved for this article.)

Improving Defective Eyes

Good lighting generally aids defective eyes even more than it helps normal eyes.

HIGHWAY REDUCES MANUAL LABOR



TYPE T-45
POLE DERRICK
for use with double drum winches

The Highway Type T-45 pole derrick is controlled by the truck operator in the cab through the manipulation of the double drum winch. On low leads the derrick is lowered by power while the truck is backed into position and then raised by power to the required height between or beyond the wires.

A special seamless and alloy heat-treated steel tubing is used in the construction of the Type T-45 pole derrick insuring a combination of maximum strength and light weight as well as a high factor of safety.

Specifications	Outside Diameter	Length
Main leg—upper section	4"	10'-5½"
Main leg—lower section	4½"	11'-2"
Side leg	3"	10'-1"
Front brace—upper section	2¾"	6'-6½"
Front brace—lower section	2"	4'-6¼"
Front brace spring	2"	6'-0"
Pole capacity	Average hgt. 55 ft.—Approx. wt. 3,200 lbs.	
Weight	Approx. 510 lbs.	

TYPE "G" WINCH ROPE HOOK
A drop forged hook with ample strength for any average pulling or lifting job. It is quickly secured around the pole for erecting or pulling.

HIGHWAY TRAILER COMPANY

MANUFACTURERS OF

TRUCK TRAILERS AND BODIES • EARTH BORING MACHINES • WINCHES • OTHER PUBLIC UTILITY EQUIPMENT

General Offices

EDGERTON, WIS., U. S. A.

LOAD SERVICING

Commercial
Industrial

Residential
Rural

Electrostatic Detearing Improves Shell Container Production

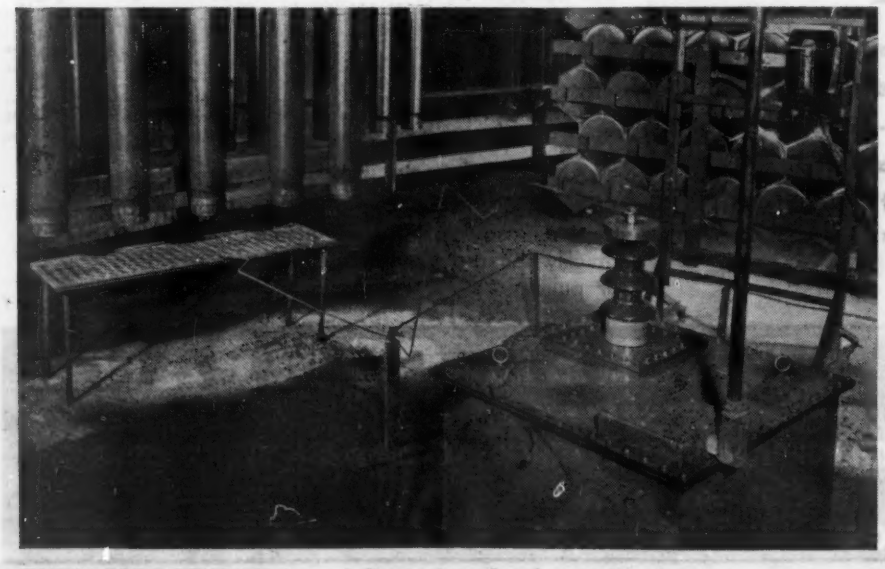
C. V. DEWITT

Industrial Sales Department, Duquesne Light Co.

Improvement of product and increase in production efficiency have been realized by the Ingram-Richardson Manufacturing Co., Beaver Falls, Pa., by the installation of an electrostatic detearer to remove excess paint from 105-mm. shell containers. The containers are watertight metal cylinders closed at one end by electric welding and with a separate cap for the other. The cylinders and caps are paint dipped and then hung on a chain conveyor, which carries them over the detearer, through an infra-red tunnel where they are preheated and then into a fuel-fired oven for final dry.

Surplus paint flows down on dipped articles, some dropping off by gravity and part accumulating in "tears" on the bottom edges. These tears remain tacky or soft after surfaces are dry, smearing anything with which they come into contact or leaving small areas exposed if they are wiped off when soft or knocked off when hard. The electrostatic detearer removes these small accumulations of paint cleanly and without impairing coverage of the dipped article.

The detearer consists principally of a transformer that steps up the supply potential to 85,000 volts. This current is changed to pulsating direct current in an electronic tube rectifier whose positive terminal is connected to a grill over which the work passes. The negative side of the rectifier is grounded; thus the work and the grid are of opposite polarities and electrostatic attraction causes the excess paint to be pulled in a fine spray to the grill, leaving clean bottom edges on the work as it moves into the infra-red preheating and final dry fuel-fired ovens.



EXCESS PAINT REMOVED from shell containers by electrostatic attraction

Infra-Red Heating Speeds Lacquer Drying

In an eastern plant contributing to the war effort jetalized sheet steel clock backs and gold and chromium plated clock sashes treated with clear lacquer were formerly dried with steam in a wooden tunnel at 100 psi. It cost about 48 cents per hr. to run the steam oven, which involved considerable waste of heat from being left on continuously each day, plus replacement of pipes, repairs of traps and a rebuilding of the tunnel every five years. An infra-red oven equipped with 24, R-40, 250-watt lamps was installed for this work, the parts dried varying from 3 to 12 in. in diameter, with heights of ⅛ to 3 in., including flat and hat-shaped items. Clock sashes were from 3 to 8 in. in diameter. The electric oven is 18 in. wide, about the same as the steam oven which it superseded; but the length was cut from 20 ft. with steam to 9 ft. with infra-red equipment, and ventilating conditions greatly improved for employees.

The R-40 lamps are mounted 10 in. above the work in standard porcelain sockets connected by slow-burning wire. Two outside rows of lamps in the center section are on a separate circuit, the lamps being set at an angle to accommodate varying shapes of work and to give corners uniform drying. The operating cost is about 7 cents per hr., and the heating-up time is nominal compared with a half-hour heating period to prepare for work under the old steam regime. Lost time due to maintenance of steam equipment has been done away with under the revised conditions of service.

Asks Dealers Reaction to Utility's Sales Plan

"What do *you* think?", was the theme question asked of dealers by Utah Power & Light Co., in submitting a sales plan to aid dealers in post-war appliance sales. A well conceived and cleverly gotten up booklet unfolded the power company's sales plan step by step. After each statement of company plan, the question was asked, "what do *you* think?" Yes or no questions were then asked with space for comment.

One of the first pages (illustrated)

Pre-viewing the New **WESTINGHOUSE**

HOME FREEZER

with

"Reach-in Convenience"

SIZES FOR BOTH CITY AND FARM

Westinghouse will build Home Freezers in sizes for city and farm. All models will be upright with front-opening doors and sectional inner doors.

- Now it can be shown. And the big news is that the new Westinghouse is an *upright* Home Freezer.
- "Reach-in Convenience" makes all frozen foods readily accessible with the many advantages of orderly storage arrangements.
- Individual inner doors enable the homemaker to select foods from any section without disturbing foods or temperatures in other sections.
- The Westinghouse Home Freezer can be located wherever it is most convenient, because it requires no more floor space than a comparable size refrigerator.
- Exhaustive tests of the Westinghouse Home Freezer, in the laboratory and in actual homes, have established remarkable records in efficiency and economy.
- Use of the Westinghouse hermetically-sealed refrigeration *system* assures years of trouble-free operation.

ASK YOUR WESTINGHOUSE DISTRIBUTOR ABOUT THE FULL LINE FRANCHISE

This new *upright* Home Freezer with "Reach-in Convenience" is just one more reason why the Westinghouse Full Line Franchise will be "hot".

30 MILLION PRE-WAR

Westinghouse

ELECTRIC HOME APPLIANCES

YOUR PROMISE OF STILL FINER ONES TO COME

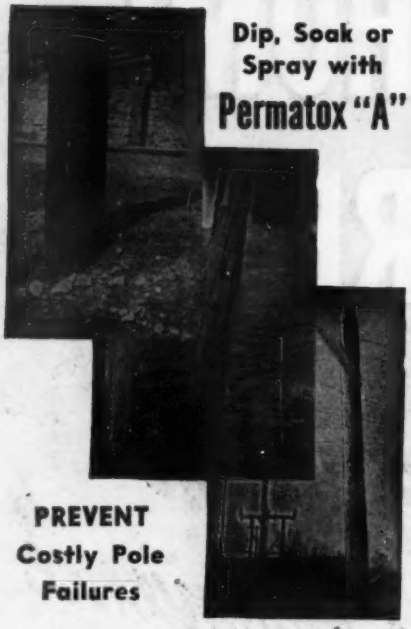
WESTINGHOUSE ELECTRIC CORPORATION • *Plants in 25 Cities . . . Offices Everywhere* • APPLIANCE DIVISION • MANSFIELD, OHIO

Tune in John Charles Thomas, Sunday 2:30 EWT., N.B.C. • Hear Ted Malone, Monday through Friday, 11:45 A. M. EWT., Blue Network

PERMATOX "A"

(A Straight Toxic Wood Preservative)

Reclaim OLD POLES
Preserve NEW POLES



Dip, Soak or Spray with Permatox "A"

PREVENT Costly Pole Failures

With the pole shortage becoming more critical, it is vitally necessary to get the utmost service from every pole now in stock or installed on your lines.

PERMATOX "A" (5% pentachlorphenol in suitable petroleum solvents) affords an effective, economical preservative treatment . . for the control of decay, shell-rot and termite attack.

Specify it for poles, posts, crossarms, ties, crossing planks, bridge timbers and other exposed construction. Soaking or pressure treatment insure adequate absorptions and deep penetration.

Furnished in Two Forms:—

DOWICIDE 7
Pentachlorphenol* crystals

PERMATOX "A"
5% Pentachlorphenol* in suitable petroleum solvents
* Manufactured by The Dow Chemical Company

Write for Bulletin—Dept. E.

A. D. CHAPMAN & COMPANY, INC.

333 N. Michigan Ave., Dept. "E"
Chicago 1, Ill.
Atlanta Memphis Portland
New Orleans New York

was devoted to the power company's policy with respect to merchandising. Others followed headed, "We plan . . . a sales force practically twice as large as at present; We plan . . . definite promotional activity on all types of electrical appliances; We plan . . . to distribute names of prospects as fairly as possible among dealers; We plan . . . to encourage dealers to operate appliance service departments; We plan . . . display space for dealers during special campaigns; increased home service; intensive cultivation of the farm market; an extensive and well coordinated advertising campaign, etc."

Early returns indicated very favorable dealer reaction to the plan. Final conclusions based on an adequate number of returns will be published later in ELECTRICAL WORLD.

Uncommon Uses for H. F. Heating—VII*

E. D. TILLSON
Testing Engineer,
Commonwealth Edison Co., Chicago, Ill.

Here are the final case studies in a series describing 14 unique applications of high-frequency dielectric and induction heating to industrial production problems. All studies are based on experiments conducted by the Commonwealth Edison Co. laboratories as a service to its industrial customers in the Chicago area.

Case 13. The laboratory was called upon to fuse thorium oxide at 5,000 deg. F. This substance is a

* Based on paper presented by the author before "High Frequency Heating Conference" sponsored by Great Lakes Power Club and Chicago Lighting Institute.

WE PLAN...

To Sell No Merchandise Ourselves

All of our efforts and plans will be directed toward the securing of new customers and the development of increased use of electric service by present customers. We will promote USE and sell advantages, assuming that the Company will not sell merchandise. The only exception to this might occur should the necessity arise, during the postwar period, of us assuming the responsibility of securing acceptance of some particular item or type of service.

We shall, of course, continue to promote the sale of electrical merchandise in all our advertising and sales activities, and shall continue to ask people to buy this merchandise at their dealers' stores.

WHAT DO YOU THINK?

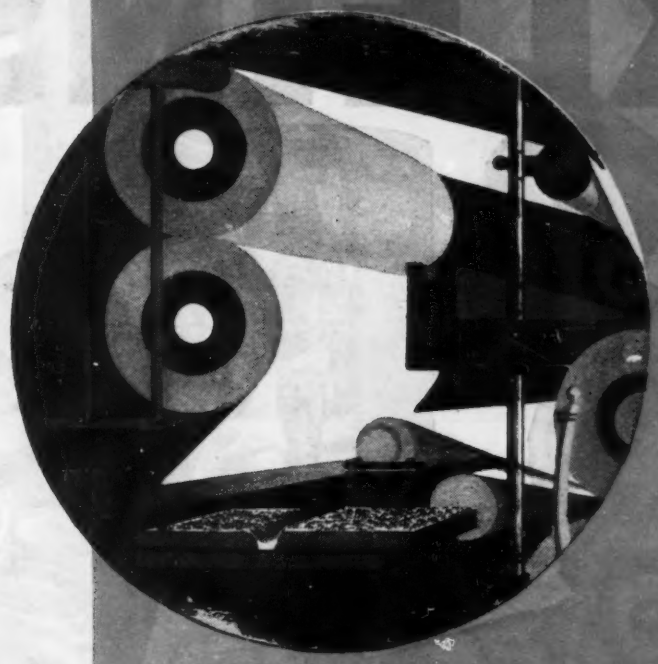
Please jot down your frank opinions and comments:

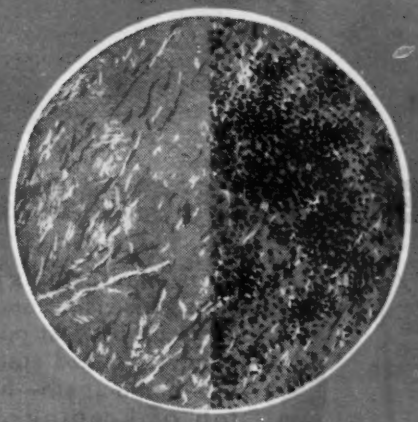
1. Are you in favor of this policy of promoting the sale of electrical appliances and equipment through dealers only? . . . . . Yes☐ No☐
2. Do you think certain items should be sold through the Power Company? Yes☐ No☐
3. If so, please tell what items and why you believe they should be sold through the Power Company

ONE OF THE "WE PLAN" PAGES from booklet sent to dealers in Utah Power & Light territory to secure dealer reaction to the power company's postwar sales plan

ONE OF THE MANY DOW CHEMICALS USED BY AMERICAN INDUSTRY

mold is generally all wet!





Dowicide

Germicides and fungicides

HOW DOW FIGHTS MOLD ATTACKS

Water—indispensable to man—nevertheless causes many manufacturing headaches. Under certain conditions, it encourages the growth of mold—destructive mold that constantly harasses production in many industries.

In one step of paper making, for example, the wet pulp mass that eventually becomes finished paper is carried on felt belts and squeezed partially dry between rollers. Being subjected to constant dampness, the felt is up against continual mold attack.

Dow research men tackled the problem and came up with Dowicide—a germicide and fungicide that increases wet felt life as much as forty to sixty per cent. Paper manufacturing has benefited immeasurably.

Furthermore, Dowicide products have helped paper producers combat other mold attacks . . . they have aided in slime control, in preserving log and pulp stock, in making packaging papers mold resistant, in reducing maintenance costs.

Similar mold problems in the textile, lumber, paint, and other industries are being successfully reduced by a Dowicide specifically designed for the job. If you are bothered by molds, fungi, bacteria, or termites, write us to find out how Dowicide can help you.

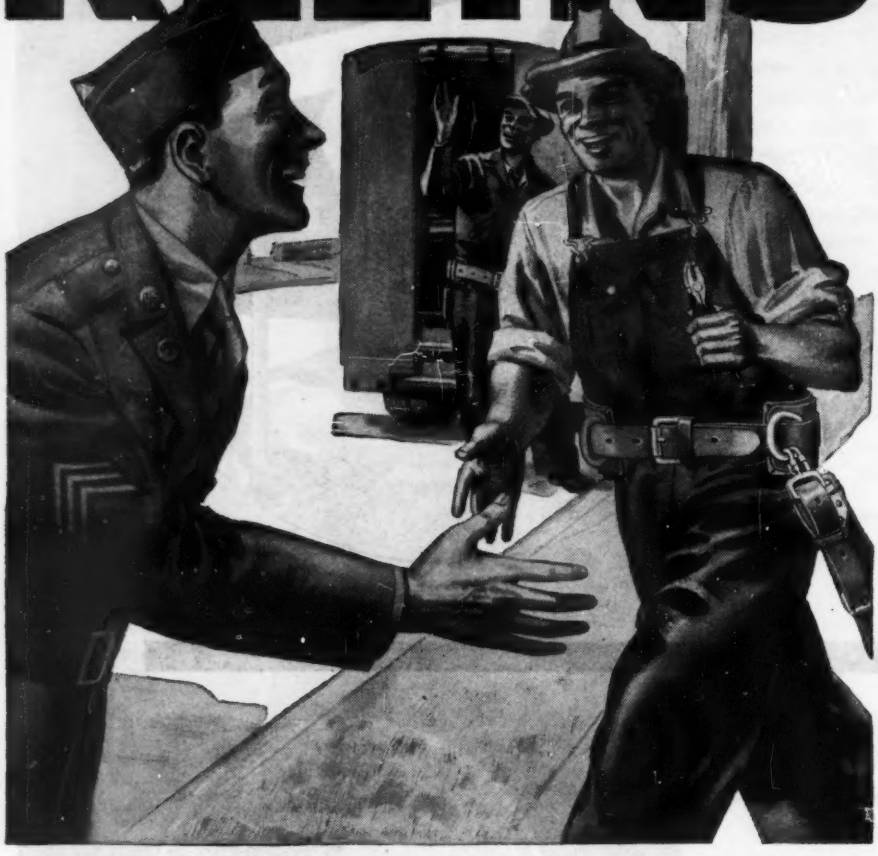
THE DOW CHEMICAL COMPANY
MIDLAND, MICHIGAN

New York • Boston • Philadelphia • Washington • Cleveland • Detroit
Chicago • St. Louis • Houston • San Francisco • Los Angeles • Seattle

DOW

CHEMICALS INDISPENSABLE TO INDUSTRY AND VICTORY

KLEINS



WHEN HE COMES HOME

● He's finished his job for the Signal Corps—strung his last communication line under enemy fire—run his last power line to light an emergency first aid station. Now he's home again—back on the job of keeping America's peacetime communications moving—the motors of industry turning.

It will feel like old times buckling on his Klein belt—fastening his Klein climbers—a pair of sturdy Klein pliers in his hand. For these quality Klein tools and equipment that served him so well in the Army will serve him as faithfully on his peace-time job as they have other linemen and electricians "since 1857."

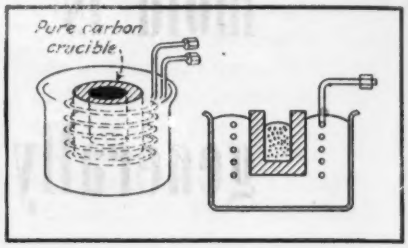
Anyone interested in linemen's equipment can obtain a copy of this folder on "Klein-Kord" on request.

ASK YOUR SUPPLIER

Foreign Distributor:
International Standard Electric Corp., New York

Mathias KLEIN & Sons
Established 1857 — Chicago, Ill., U.S.A.
3200 BELMONT AVENUE, CHICAGO 18, ILLINOIS

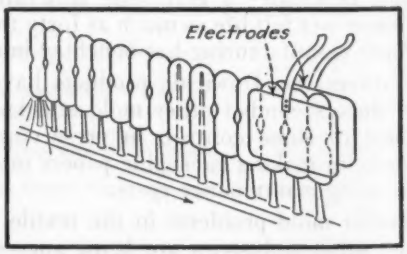
chemically-pure precipitate, white in color, that is used for gas mantles, high-temperature tubes, breakers, etc. Several methods of fusing thorium oxide were tried before one was developed which appears thoroughly practical. This involves the use of a special induction heat-



CASE 13—Fuse 2 oz. of thorium oxide in 14 min. with induction heating

ing coil of six turns, 3-in. inside diameter, bedded in 6-in. hard-glass container together with a carbon crucible 2 in. in diameter and 3 in. high containing the oxide to be fused. Space between outside of the crucible and the walls of the outer container are also filled with thorium oxide packed around the coils. In this case the oxide was used as a heat insulator. Its insulating value when used in this manner is very high. A 2-oz. load of thorium within the crucible is fused in 14 min. The only known alternative is electric arc fusing of very small quantities, a relatively tedious, uncertain method believed to be wasteful of thorium.

Case 14. Problem is the sterilization and drying of glass ampoules that are to be later filled with sulfa drugs, penicillin, etc. After sterilization the moisture must be removed from the ampoules. In the process worked out, the ampoules are



CASE 14—Dry drug ampoules, after sterilization, with high frequency heat

mounted on hollow needles through which distilled water and air are successively sprayed. All this occurs on a conveyor belt as shown. The final operation is the drying with high frequency dielectric heat while the ampoules are still supported on the needles. The speed of production is about 60 per minute.

THIS RADIAIR OVEN IS VITAL IN WAR—VALUABLE IN PEACE
Wartime Uses—drying small airplane wing sections, large stampings, metal panels and semi-large flat parts. **Peacetime Uses**—drying name plates, bottle caps, lacquered paper ceramic dishware, panel surfaces.

Infra-Red RADIANT HEATING IS A PRECISION PRODUCTION TOOL!

C. M. HALL Radiair OVENS

Fit Right Into the Production Line... Set New Standards of Industrial Heating ★ Drying ★ Baking ★ Dehydrating

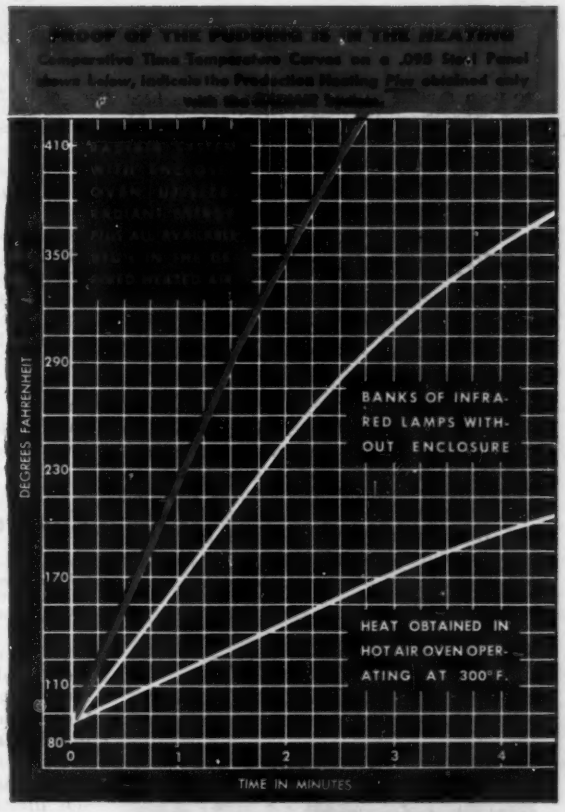
Old established methods of heat transfer and many conventional heating practices are being obsoleted by the increasing acceptance and use of infra-red radiant heating as a precision production tool. Meeting the complex demands of war production finishing has put infra-red radiant heating with its new techniques right into the production line, supplementing, complementing or taking the place of present heating equipment.

C. M. Hall RADIAIR Ovens always have incorporated the *time-saving benefits* of instant heat through radiant energy and the *extra-use value* of recirculated derived heated air to produce greater overall thermal efficiency.

The economies of RADIAIR heating vs. other heating systems cannot be made on a basis of unit-of-heat cost alone, since RADIAIR oven users find that many other advantages make it a real cost saver. These advantages include, *greatly increased production, lower equipment, installation and maintenance costs, greater flexibility and ease of control, reduced space requirements, added safety* and *cleanliness.*

It will pay you well to learn NOW, just what C. M. Hall *Productioneered* Radiant Heating has to offer in meeting your War and Postwar production needs. You will find you were wise to CALL ON HALL FOR HEAT.

"INFRA-RED AT WORK" *describes the many practical applications of this new production heating process.* **SEND FOR A COPY TODAY.**



C. M. HALL LAMP CO. HEATING DEHUMIDIFYING DEMISTING

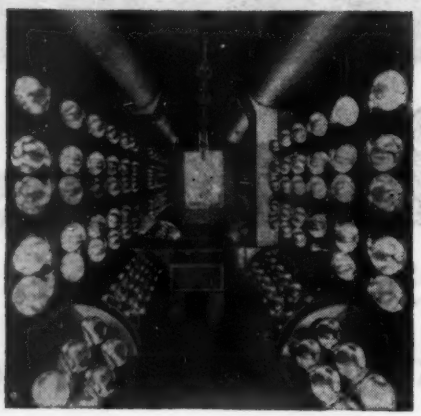
C·M·HALL Lamp Company

PIONEER DESIGNERS AND BUILDERS OF INFRA-RED RADIANT HEATING EQUIPMENT

1035 EAST HANCOCK ST. — *Representatives in Principal Cities* — DETROIT 7, MICHIGAN

NEW EQUIPMENT

Heating Equipment



Raymersion industrial heating equipment: **Trumbull Electric Mfg. Co.**, Plainville, Conn.

Prefabricated infrared ovens are stated to be available in any size for various heating capacities. It is stated to be applicable to all types of production in which infrared is used and to be adaptable to various handling methods.

•

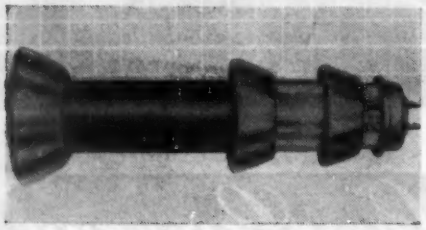
Spraying Equipment

Model "FP" sprayer: air pressures 20 to 60 psi.; thumb control of fine to course to pour application. **Alloy-Sprayer Co.**, 602 First National Bldg., Ann Arbor, Mich.

Control of the spray is stated to make the equipment applicable to laboratory research work as well as spraying selenium rectifier cells, rectifier discs, protective coating of wood patterns, and similar types of spraying. Among the features reported are (1) metal or alloy can be added without interrupting spraying operation, (2) can be added intermittently and (3) does not need to be in special form.

•

High Frequency Tube

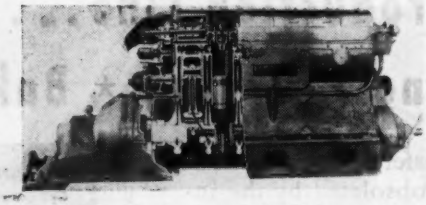


High frequency tube: output 200 kw.; 3 electrodes; thermionic emission, 120 amp. **Federal Telephone & Radio Corp.**, Newark, N. J.

Powerful high frequency tube designed for use in broadcasting and industrial heat applications. Specifications state the output to be 200 kw. when used as an oscillator or in Class C Telegraphy, with a plate voltage of 18 kv. and a plate dissipation of 150 kw. As a Class C plate modulated amplifier, the carrier power output is reported as 100 kw. with a plate voltage of 12.5 kv.; the peak instantaneous power output at full modulation is reported as 400 kw. Tube requires 40 gallons of water per minute for cooling.

•

Diesels



Series 20 Diesels: 6 and 8-cylinder models; 190 to 250 hp. at 900 r.p.m.; single acting, 7¼-in. bore and 8½-in. stroke. **Joshua Hendy Iron Works**, Sunnyvale, Calif.

Units are made in diesel-electric, marine and stationary models and are of the 4-stroke cycle type. They are air starting and completely enclosed—with overhead camshaft, unit fuel pumps and injectors, and pressure lubrication. Engines are cast-iron, mono-block construction with underhung crankshaft, removable cylinder liners, and auxiliary drive at either end. Among attached accessories reported are air compressors, governor, water and lube-oil circulating pumps, fuel-transfer pump, lube and fuel-oil filters, lube-oil cooler, and gage board.

•

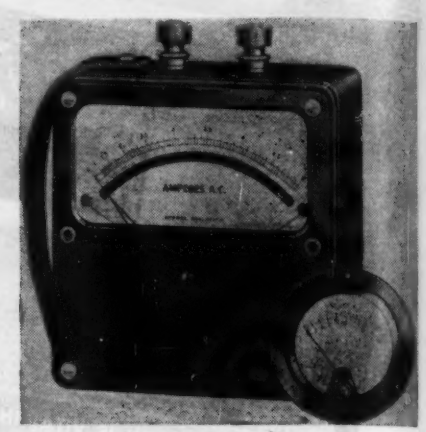
Electrode Holder

Armored-clad (screw type) insulated electrode holder: accommodates electrodes up to ¼ in. in diameter; weight 15 oz. **General Electric Co.**, Schenectady, 5, N. Y.

Head of the insulated holder is said to be completely enclosed in a sheath of aluminum armor. This is said to protect the insulation, to resist weld spatter and to eliminate accidental contact with welding circuit. Twist of hand tightens or releases the electrode. Width of electrode slot limits size of electrode which can be inserted and thereby prevents overloading holder.

BUYING ELECTRICAL EQUIPMENT?—McGraw-Hill's *Electrical Buyers Reference* is a convenient place to look first for manufacturers' product data, names and addresses.

Instruments

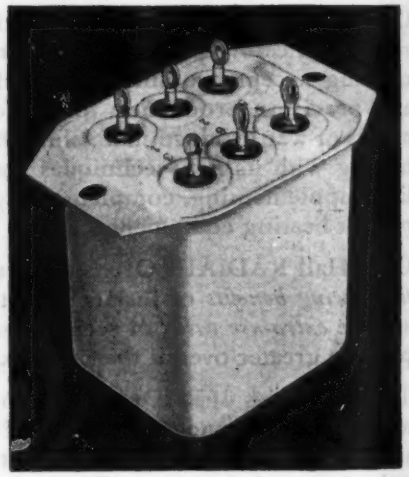


Ammeters, voltmeters and wattmeters: compensated for 25 to 3,000 cycle range. **Weston Electrical Instrument Corp.**, 617 Frelinghuysen Ave., Newark 5, N. J.

Frequency compensated instruments are available for voltage, current and wattage measurement—in both portable and switchboard types. They are of the moving iron vane and dynamometer type design and is stated to maintain accuracy over the 25 to 3,000 cycle range.

•

Transformer



Type "T-7803" output transformer. **Acme Electric & Mfg. Co.**, Cuba, N. Y.

Series of hermetically sealed aluminum case output transformers utilize steel cores and special vacuum impregnated coils. Terminals of Pyrex glass with Kovar electrodes and metal collars are reported to form a seal which complies with the standards established for the five cycle immersion tests.

•

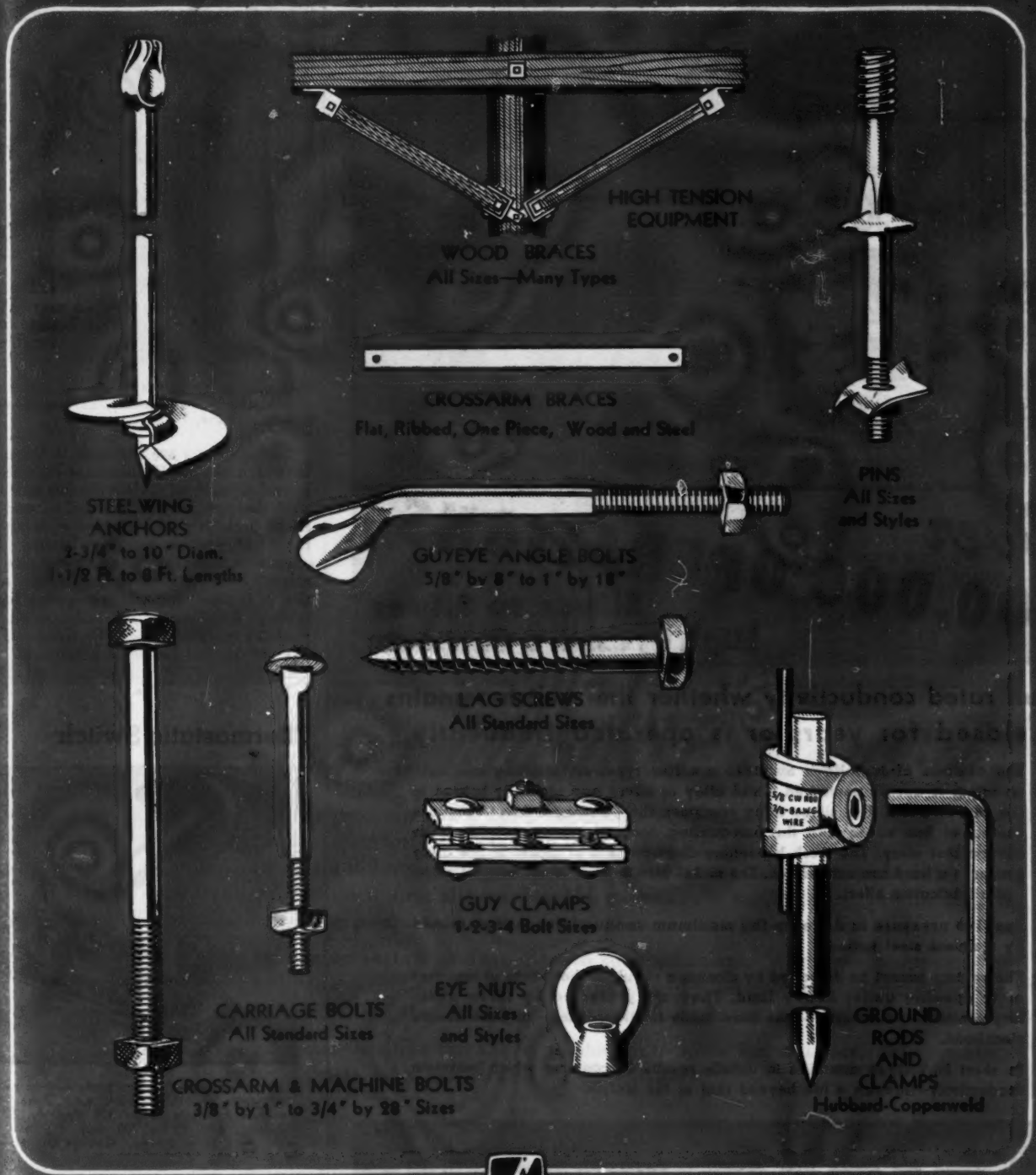
"Non-Spatter" Film

Welding film, in concentrated form: available, in 5 gallon cans; **Lincoln Electric Co.**, Cleveland, Ohio.

A liquid which is said to minimize adherence to welding spatter and to reduce cleaning time. It is applied in diluted form (three parts water to one part of the concentrate) by brush or air gun. After welding the spatter is reported as easily removed by wiping or brushing. It is also stated that welding can proceed whether film is wet or dry, that priming coats of paint may be applied over the film, that

1945 CONSTRUCTION

"Hang the Load on Hubbard Hardware!"



HUBBARD

HUBBARD AND COMPANY

Pittsburgh • Chicago • Oakland, California

Full rated conductivity whether the switch remains closed for years or is operated frequently

The contacts of Hi-Voltage Switches are line type, self-aligning and self-cleaning. A ductile powdered metal alloy of silver and nickel is brazed to the copper parts. The silver alloy combines the permanent low resistance contact of fine silver with the non-gauling, long life characteristic of the silver-nickel alloy. The work hardening characteristic of nickel in the alloy produces a hard contact surface. The nickel also imparts to the contact material a lubrication effect.

Positive pressure to develop the maximum conductivity is maintained by stainless steel springs.

The contact cannot be damaged by closing a circuit of thousands of amperes or in opening under heavy load. They are protected by three auxiliary contacts — the horns — the base guide for the blade — and the bronze sleet hood.

In short Hi-Voltage attention to details results in contacts which maintain conductivity—through a life beyond that of the station.

HI-VOLTAGE
EQUIPMENT COMPANY
2891 East 79th Street • Cleveland 4, Ohio

washing with water will remove the film, that one application is effective for multiple-pass welding, that if applied to parts prior to being normalized, the oxide film and ordinary scale can be removed more easily after heat treating, and that the properties of the material are not affected by freezing.

•

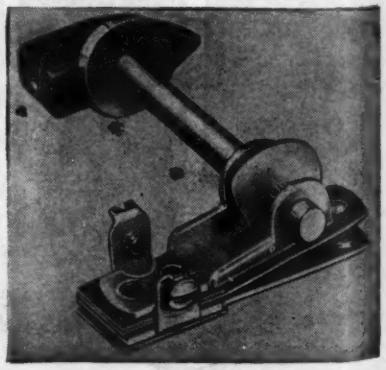
Fire Extinguishers

Models 15, 10, and 4, "Alfite Speedex" fire extinguishers. American LaFrance-Foamite Corp., Elmira, N. Y.

Extinguishers are available in three sizes in which the model numbers indicate the pound capacity of carbon dioxide gas. Units were designed for use on small oil and electrical fires. Operating valve is located directly above the carrying handle. It is opened by hand grip pressure and closed by releasing the grip. For continuous operation a D-yoke ring is slipped over the operating lever while it is depressed. All models are stated to bear Underwriters' and Factory Mutual Laboratory approval.

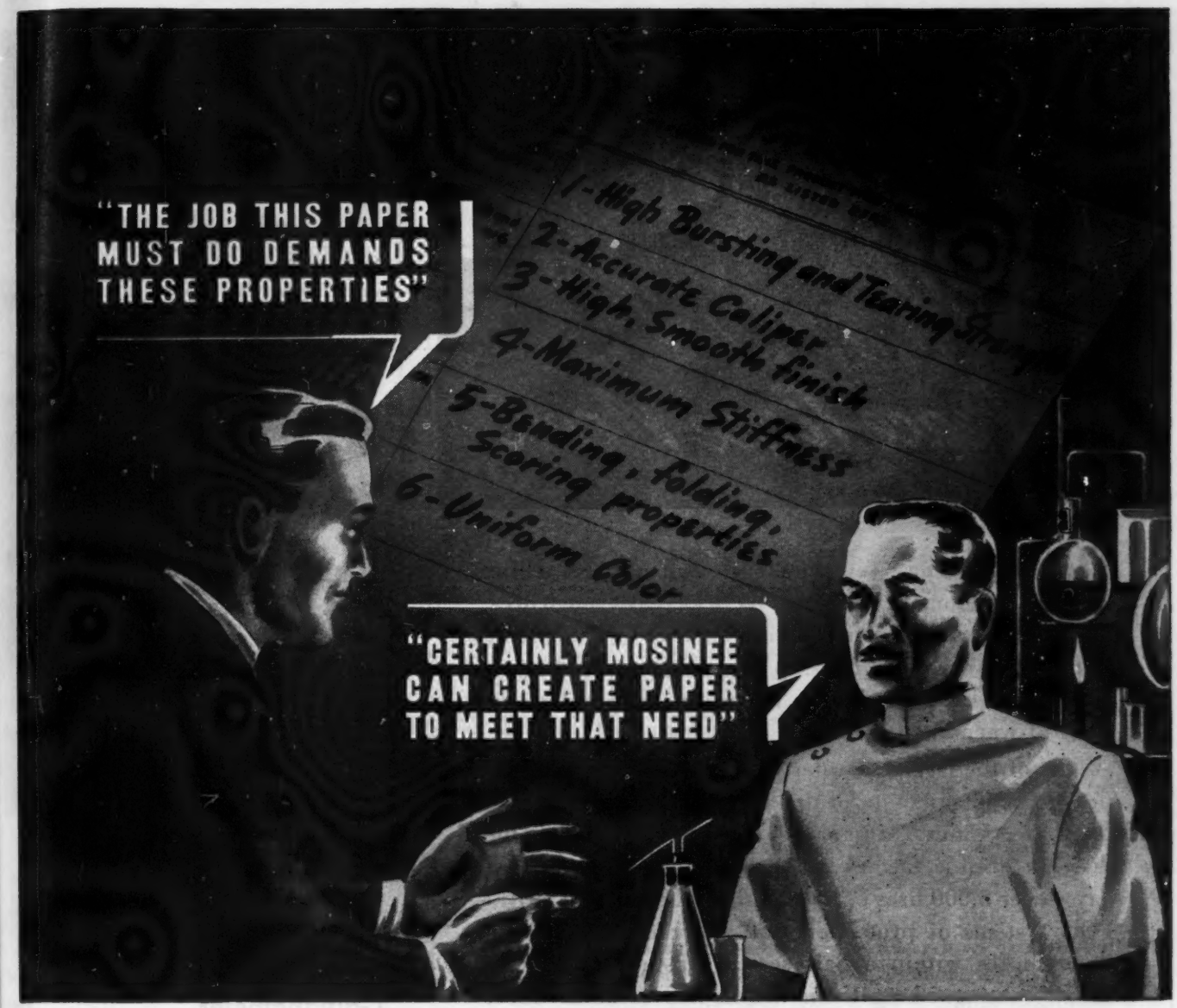
•

Thermostatic Switch



Dual cam-adjusted thermostatic switch: rated, 1500 watts at 115-230 volts a.c.; three temperature brackets 50 to 300 deg. F., 50 to 450 deg. and 50 to 700 deg. F.; mounted with two 6/32-in. screws. George Ulanet Co., 88 E. Kinney St., Newark, N. J.

Combination "on and off" switch and thermostatic switch made in a single unit. It is stated to be applicable to electrically heated equipment such as glue pots, hot plates, etc., where manual "on and off" switch is desired. The knob can be located any distance from the thermostatic element by lengthening the cam shaft. The pointer on the knob is set to the desired tempera-


"THE JOB THIS PAPER MUST DO DEMANDS THESE PROPERTIES"
1-High Bursting and Tearing Strength
2-Accurate Caliper
3-High, Smooth finish
4-Maximum Stiffness
5-Bending, folding, Scoring properties
6-Uniform Color
"CERTAINLY MOSINEE CAN CREATE PAPER TO MEET THAT NEED"

- - and MOSINEE made it!

Your paper problem is not apt to be identical to that of even your most direct competitor . . . Although you both may be aiming at the same end-result, there probably is a difference in procedure or equipment . . . and for such differences you may need a specially engineered paper . . . it might speed production, or improve your product, or both!

Mosinee paper technicians are alert to such situations. When given opportunity to know what paper properties you require, and what your production set-up demands, the Mills of Mosinee adjust *their* processes to meet *your* paper requirements.

With information like the above, we can go to work immediately. What properties or characteristics are needed for your paper?

MOSINEE PAPER MILLS CO. MOSINEE, WISCONSIN

Please address your letter "Attention Dept. B"

MOSINEE PAPER MILLS COMPANY

MOSINEE • WISCONSIN

Essential Paper Makers

"Automatic"
FIRE-FOG
• IT BLANKETS • IT ISOLATES • IT QUENCHES •

A War Time Must
-a Peace Time Need

DURING the past several months we've been telling you how "Automatic" FIRE-FOG licks really tough fires, particularly those originating in oils or other flammable liquids. Now, with censorship wraps off, here's the protection FIRE-FOG offers in the manufacture of munitions of war:

One of the largest powder plants in this country is at present producing tons of the new Rocket Powder under the protection of "Automatic" FIRE-FOG systems. One division of this factory alone averages 185 fires each day—over 5,000 fires every month! "Automatic" FIRE-FOG systems of protection put a torrent of water on these blazes within a half second of their inception, usually extinguishing them within five seconds. Most important, there are no injuries, no machinery damage, and often much of the powder remains unburned. Production at the powder rolling machines is restored within a matter of minutes.

All this has been made possible through the close cooperation of the powder manufacturer and "Automatic" engineers . . . *just the sort of cooperation between your staff and "Automatic" engineers that will result in licking your toughest fire problems in the peace time products of tomorrow . . . and TODAY.*

"Automatic" Sprinkler

"AUTOMATIC" SPRINKLER CORPORATION OF AMERICA
YOUNGSTOWN, OHIO . . . . . OFFICES IN 36 CITIES

"Automatic" manufactures and installs a complete line of fire protection devices and systems for all types of fire hazards. Listed by Underwriters' Laboratories, approved by Factory Mutual Laboratories.

ture which is controlled by the thermostat. Temperature is increased, or decreased or the heating unit disconnected from the circuit by turning the knob.

•

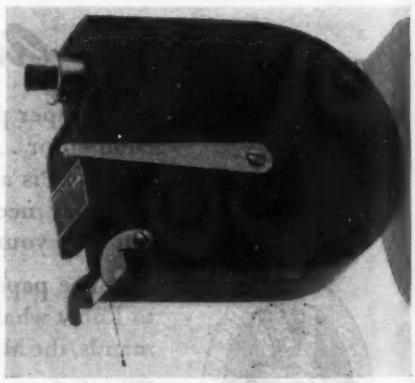
Transformers

No. 400 series, input transformers: 3 types; operating level plus or minus 10 v.u. at 0.001 milliwatt reference level; 2-in. center to center mounting, 1½-in. O.D. by 2¼ in. high. **Langevin Co., Inc.**, 37 West 65th St., New York 23, N. Y.

Transformers are stated to be applicable to high quality amplifier requirements, to occupy minimum of space and to combine high permeability shield with rotatable strap mounting for minimum stray field pickup. The three-types are: 401-A operating from 30/250/600 ohms primary to 30,000 ohms secondary tapped, the 400-C with a nominal impedance of 600/15,000 ohms to 60,000 ohms secondary and type 402-A with a nominal 30/120 ohms primary to 50,000 ohms secondary.

•

Galvanometer

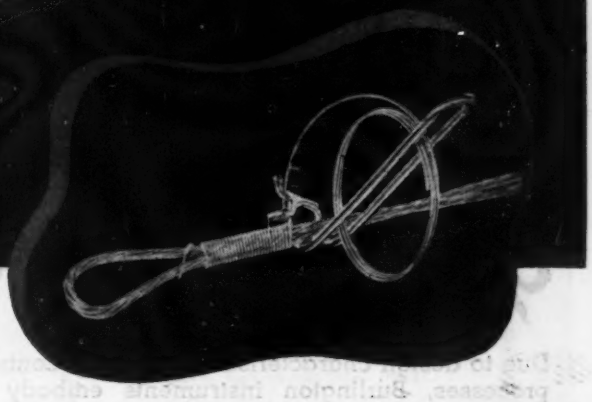


Recording galvanometer: d.c. and up to 120 c.p.s.; max. swing 20 mm. each side of center line; no overshoot up to 70 c.p.s.; penmotor impedance, 1,500 ohms; minimum sensitivity, 1.1 mm. per volt, 1.6 mm. per ma., 21 volts full scale; dimensions 5 inx4 inx1⅝ in. **Brush Development Co.**, 3405 Perkins Ave., Cleveland 14, Ohio.

Unit is stated to embody a low mass, 3-in. tapered tube pen which is actuated by a permanent magnet pen motor. Pen is Pyrex tipped and records pressures, vibrations, strains, currents or voltages. Frequency response stated to be flat to 70 c.p.s. and accurate to 120 c.p.s. It is available in single and 3-speed paper drives and chart widths of 2 in. and 12 in.

GOOD THINGS

come in small packages



Lots of truth in that old saying. Many a lineman has learned how well it applies to the Bethlehem serving tool.

This little gadget is simple, light in weight, easy to carry . . . but what a big job it does on a dead-end serve! Using a 10-ft. coil of 11-gage bethanized wire, the lineman hooks one end in place on the strand; then, engaging the wire between the fingers of the serving tool, he wraps it solidly in place with a simple rotary motion.

Well, you say, that's all very fine. But what are the advantages of the Bethlehem serving tool from *my* point of view?

Fair enough question. Here are some answers:

★ *Clean, strong serves.* Laboratory tests have shown conclusively that this type of serve holds beyond the useful strength of the strand.

★ *Economy.* Bethlehem dead-end wire, used with the tool, costs only a few pennies per 10-ft. coil—considerably less than even a single inexpensive clamp; and only one size of coil is needed for the commonly used sizes of strand.

★ *Basic simplicity.* That's one of the best things about the serving-tool technique. After a very little practice, your linemen can make their serves in about the time required to attach conventional clamps.

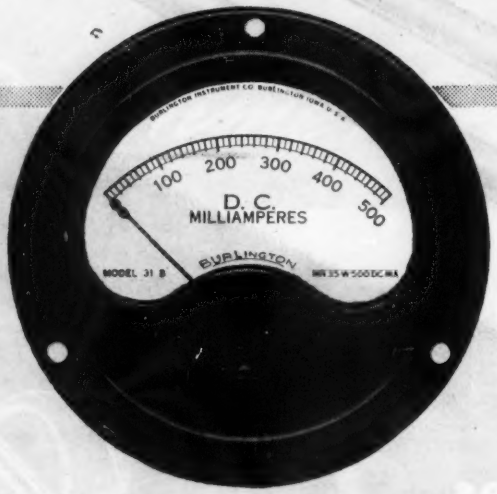
The serving-tool method is recommended primarily for use with bethanized strand and wire. Bethanizing, an electrolytic process used exclusively by Bethlehem, applies a corrosion-resisting zinc armor to every wire in the strand. Because of its unusual ductility, this coating is not displaced to any harmful extent by the action of the serving tool.

Ask a Bethlehem man for full details.

★ ★ ★ BETHLEHEM STEEL ★ ★ ★

Burlington

PANEL INSTRUMENTS



Guaranteed ACCURACY

Due to design characteristics and close control of manufacturing processes, Burlington instruments embody the following advantages:

PERMANENCE OF CALIBRATION . . . All DC instruments employ Alnico magnets which are known to be more highly resistant to shock, heat, vibration, and stray fields than any other magnetic material.

FREEDOM FROM STICKING . . . Clearances for all moving parts are such that the results of entrance of small particles as encountered in field service are reduced to a minimum.

STABILITY OF OPERATION . . . All instruments are "NORMALIZED" after assembly to eliminate "zero shift" and other calibration errors due to ageing.

Exceptionally high torque to weight ratio of control springs to moving element insures minimum error under conditions of shock, vibration, and other rough usage.

Alignment of jewels and magnet core piece is such that the center lines of these parts coincide within plus or minus .002". The design of the brass movement frame and components is such that mechanical tolerances are reduced to a minimum in assembly. As a result, jewel and pivot wear is uniform which reduces "frictional torque" of the moving coil.

All series resistors and coils are heat treated and impregnated after wrapping to insure stability and long life.

All ranges AC & DC are available in 2½", 3½" and 4½" sizes, both square and round, flush mounting.

Engineering service furnished for specialized applications. No obligation. Write today for further information.

BURLINGTON INSTRUMENT CO.
300 FOURTH STREET
BURLINGTON, IOWA

B

PANEL INSTRUMENTS • VOLTAGE REGULATORS • AUTOMATIC SYNCHRONIZERS • FREQUENCY REGULATORS

TECHNICAL LITERATURE

Feed Water Treatment—Bulletin 451 issued by Milton Roy Pumps, 1300 E. Mermaid Ave., Philadelphia 18, Pa., explains two methods of treating boiler water. First, the sodium sulfite fed to the suction side of the boiler feed pump and, second, other treating chemicals fed directly into the boiler drums. It lists equipment required in each system by boiler pressures, by make-up water requirements, etc.

Distribution Transformers—Copies of Bulletin No. 114, a 32-page booklet, on distribution transformers may be obtained from R. E. Uptegraff Mfg. Co., Scottdale, Pa. It contains tables of (1) standard dielectric tests for transformers, regulators and reactors, (2) preferred ratings of transformers, (3) standard withstand voltages for apparatus bushings, (4) dielectric tests for distribution, power and regulating transformers, and shunt reactors, and (5) accessories for transformers of 500 kva and below.

Insulation—"Facts About Fiberglas for Design Engineers" is the title of a booklet which may be procured from Owens-Corning Fiberglas Corp., Toledo, Ohio. It lists in a convenient table for the designer the properties, forms and uses of various materials made with the insulation.

Silicon Steel—Technical bulletin on the subject of "Silicon Steel Coiled Strip and Silicon Steel Sheets" may be obtained from Republic Steel Corp., Republic Building, Cleveland 1, Ohio. It contains core loss data, magnetization curves and permeability curves on the several grades of the company's steels most generally used at this time.

Lighting—"Lighting Drafting Rooms" is the subject treated in *Architexts*, a publication which can be obtained from the Holophane Co., Inc., 342 Madison Ave., New York 17, N. Y. The difficult task of providing proper seeing conditions in the drafting room is described and the results obtained in a utility drafting room are depicted by photographs.

Motors and Controls—Bulletin No. GEA-4131 entitled "Motors and Control for Hazardous Locations" may be obtained from News Bureau, General Electric Co., Schenectady, N. Y. It contains explanations of types of hazardous locations, of what is explosion-proof equipment, Underwriters' design and text requirements, Bureau of Mines design and test requirements, how to apply explosioin-proof equipment as well as a historical sketch of the development of the explosion-proof motor.

Corrosion—"Corrosion in Unit Heaters" is a 12-page booklet obtainable from D. J. Murray Mfg. Co., Wausau, Wis. It describes corrosion and its influence on unit heaters and their operation. Contains this information under such headings as: (1) What is corrosion? (2) What prevents corrosion? (3) One metal resist corrosion. (4) What metals are vulnerable to corrosion? (5) Where certain metals should not be used and (6) Selection of proper unit as important as machinery for production line.

Steel—A 32-page bulletin entitled "Non-Magnetic Applications for Amsco Manganese Steel" contains results of studies of use of manganese steel in applications where non-magnetism and ability to withstand shock and wear were important considerations. These applications include lifting-magnet cover plates, collector shoes, fingers for stator cores, magnetic separator drums and rollers, electric furnace parts, etc. This bulletin, No. 1144-NM, may be obtained from American Manganese Steel Division, American Brake Shoe Co., Chicago Heights, Ill.

THE TRUCK WITH THE BATTLEFRONT BACKGROUND

● One of the battlefront jobs of the Ward LaFrance Heavy Wrecker, M1A1, is to move in under the very nose of the enemy and remove damaged tanks and other vehicles to a repair base where they can be put in fighting condition again. The M1A1 has performed amazing feats, under the worst possible operating conditions, on all major fronts, where human life depends on *performance*.

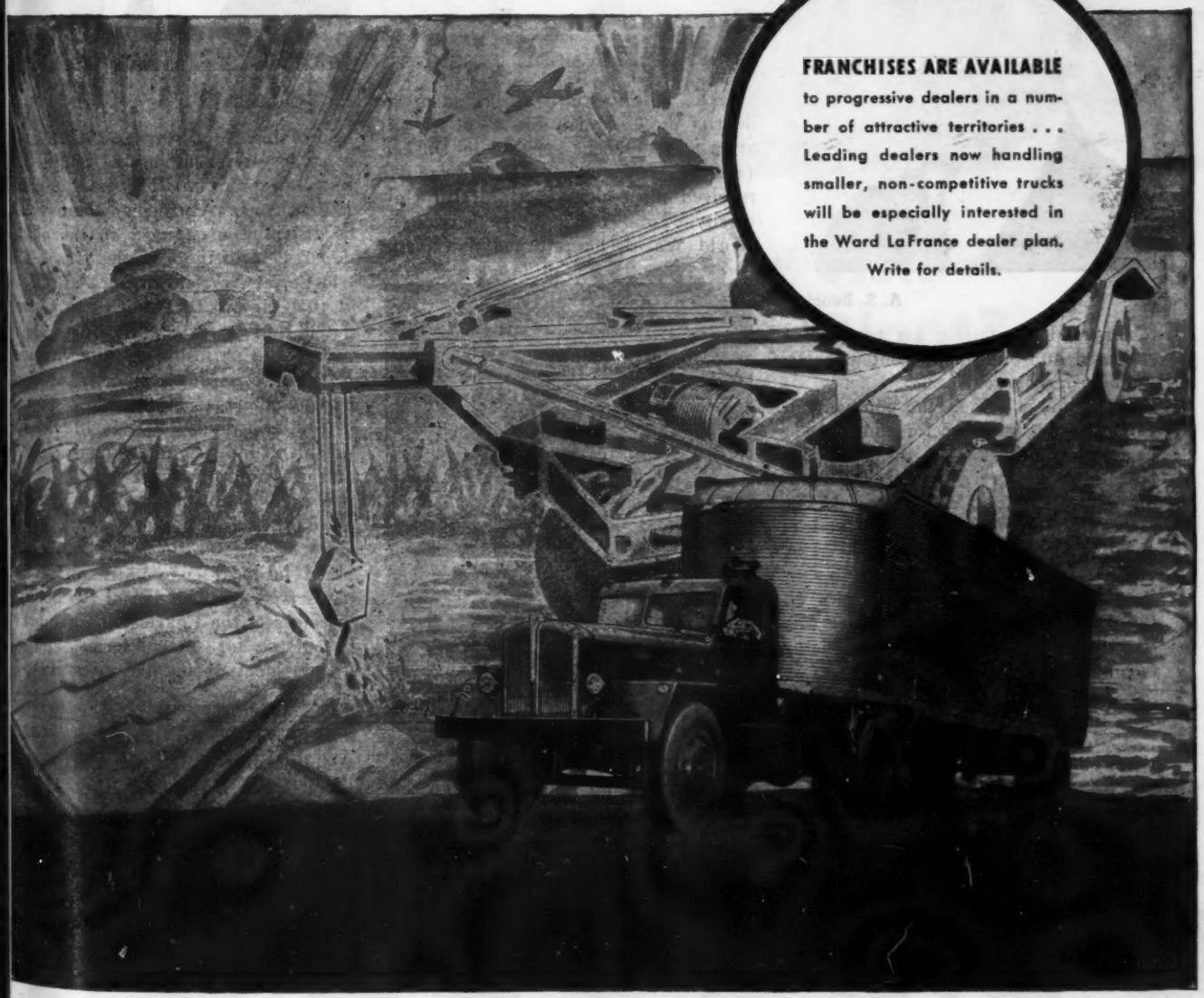
Building such good trucks is not new to Ward LaFrance, but our new commercial models, inspired by the outstanding record of this 6 x 6 Ordnance vehicle, are by far the best trucks we have ever manufactured. Like the M1A1 they are big and tough with pay load capacity ranging up to 30 tons. They're the trucks with the "battlefront background"... designed, engineered, and manufactured for low-cost hauling. Now available to essential users. See your local Ward LaFrance dealer. If there is no dealer in your locality, write direct.

GAI

WARD LAFRANCE

TRUCK DIVISION

GREAT AMERICAN INDUSTRIES, INC. • ELMIRA, NEW YORK



FRANCHISES ARE AVAILABLE to progressive dealers in a number of attractive territories . . . Leading dealers now handling smaller, non-competitive trucks will be especially interested in the Ward LaFrance dealer plan. Write for details.

NEWS ABOUT PEOPLE

Utah Power Elects Bennion Vice-President

Election of Dr. Adam S. Bennion as vice-president of Utah Power & Light Co. has recently been announced. The company's relations between its employees, its stockholders, its customers and the public are being consolidated into one department with Dr. Bennion in charge.

A. S. Bennion

Dr. Bennion joined the company in 1928 as personnel director and in 1934 he was made assistant to the president. He holds a master's degree from Columbia University and a doctor's degree from University of California and is widely known as an educator, speaker, civic leader and business man. During a period while his connection with U. P. & L. was terminated, Dr. Bennion was Republican candidate for U. S. senator from Utah last fall.

•

► H. B. HERYFORD, who has been associated with the Pacific Gas & Electric Co. for 42 years, serving as manager of the Stockton division for the past 17 years, has retired. He will be succeeded by ARTHUR D. CHURCH, now office assistant in San Francisco to A. Emory Wishon, vice-president and general manager of the company. Mr. Heryford started in the utility business in 1903 with the Colusa Gas & Electric Co., which later became part of the P.G. &. E. system. Mr. Church has been associated with Pacific Gas and its predecessor companies since 1914.

► FERDINAND O. WALD has been appointed meter superintendent of the Utah Power & Light Co., Salt Lake City, to succeed WALTER J. MCMINN retired. Mr. Wald has been with the Utah Power & Light Co. since 1920. Mr. McMinn retired after completing 38 years of service.

•

Canadian Group Elects J. K. Wilson President

J. K. Wilson, who was elected president of the Canadian Electrical Association at the recent meeting in Quebec (ELECTRICAL WORLD, June 30, page 4), received his education at McGill University. Following military service in World War I, he returned to Canada and after completing his engineering course at McGill, he joined the Canadian Fairbanks-Morse Co. and the Barrett Roofing Co.

J. K. Wilson

It was in 1928 that Mr. Wilson joined the staff of the Shawinigan Water & Power Co. as merchandising manager in the commercial and distribution department.

E. L. Godshalk Elected President of S.E.E.

Ernest L. Godshalk, who was elected president of the Southeastern Electric Exchange at the meeting held recently in Atlanta, (ELECTRICAL WORLD, June 30, page 6), has been president of the South Carolina Power Co., Charleston, since 1936.

A graduate of the University of Pennsylvania, Mr. Godshalk entered upon his utility career with the Charleston Consolidated Railway & Lighting Co., a predecessor company of South Carolina Power Co. in 1917, remaining until 1919 when he returned to Pennsylvania as distribution engineer in the electric department of the Counties Gas & Electric Co. at Norristown, Pa., an affiliate at that time of the Charleston Consolidated Railway & Lighting Co. He returned to Charleston as superintendent of the electric department in 1922, becoming manager of electric operations of South Carolina Power in 1929, a vice-president and general manager in 1932 and president nine years ago.

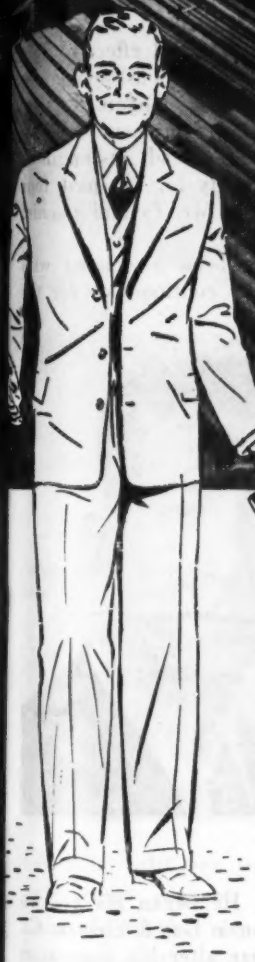
Harris & Ewing

E. L. Godshalk

Mr. Godshalk has been active in the affairs of the Southeastern Exchange since its organization. He has participated in local community affairs and has served as a member of the board of directors of the Charleston Chamber of Commerce for several terms, and was its president during the years 1942-43.

•

► MORTON B. FOWLER, vice-president and treasurer of the San Diego Gas & Electric Co., has retired after 41 years of service. Mr. Fowler's association with the company began in 1897 when he went to work for Dr. R. M. Powers, one of the founders. Subsequently he was made secretary of the utility when it was purchased by H. M. Byllesby & Co. The system later became a part of Standard Gas & Electric properties, and



Did You Ever Visit A Steel-Service Plant?

Let's take a quick look inside one of the 11 Ryerson Steel-Service plants. Before us stretch acre upon acre of steel in countless shapes and sizes—giant structurals, gleaming sheets of Allegheny Stainless, towering racks of alloy bars.

Everything is movement. A friction saw roars as it bites through a beam. We hear the dull crunch of heavy shears. Overhead a giant crane is speeding tons of plates to the loading door. Hundreds of tons are continuously moving out of stock to supply war industry and to speed partial conversion to peacetime production.

Today sizes may not always be in balance because of heavy wartime demands and we cannot always give the service you have come to expect from Ryerson. But our stocks are still the nation's largest. Deliveries generally prompt. Service interested and helpful. When you need steel quickly from stock phone the nearest Ryerson plant.

Principal Products

…rs, Shapes, Plates, Sheets, …oor Plates, Structurals, …bing, Allegheny Stainless, …oys, Tool Steel, etc.

Write for Stock List

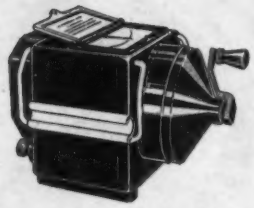
Joseph T. Ryerson & Son, Inc., Steel-Service Plants: Chicago, Milwaukee, Detroit, St. Louis, Cincinnati, Cleveland, Pittsburgh, Philadelphia, Buffalo, New York, Boston.

RYERSON CERTIFIED STEELS

RYERSON

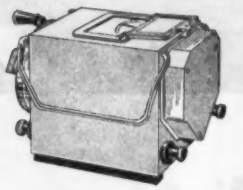
"MEGGER"
TRADE MARK REGISTERED U. S. PAT. OFF.

The registered trade-mark "Megger" is not the name of any single device; it is neither adjective nor noun; of itself, it has no generic or descriptive meaning. "Megger" is simply the mark or symbol identifying a specific brand of insulation testers, megohmmeters, ground testers, ohmmeters and other measuring and testing devices.



"Megger" Insulation Testers

"Meg," "Super-Meg" and Midget types to meet practically all requirements for testing insulation resistance of electrical equipment. Ratings up to 2000 megohms and 1000 volts d-c. Hand-cranked generators always ready for use. 500-volt models are most popular. *Bulletins 1735-W and 1785-W.*



"Megger" Ground Testers

Undoubtedly the most simple and reliable devices ever developed for measuring resistance to earth of ground rods, metal structures and other ground connections. Hand-cranked generators. Ranges as low as 0 to 3 ohms and as high as 0 to 30,000 ohms. *Catalog 1645-W.*

"Megger" Ohmmeters

Illustrated is the low resistance "Ducter" type for switch, circuit breaker and contact resistances, direct indicating down to .000001 ohm. Operated by storage battery. "Ducter" measurements identify incipient trouble and forestall failure. *Bulletin 1635-W.*

★ Three important electrical maintenance tools . . . direct indicating . . . simple to operate . . . rugged and highly dependable . . . generally accepted for maximum reliability and economy in field use.

Let us explain why and how "Megger" instruments are used in testing and maintenance work; why there is a place for them in nearly every electrical equipment maintenance routine.

JAMES G. BIDDLE CO. • **1211-13 ARCH STREET PHILADELPHIA 7, PA.**

in 1932 Mr. Fowler was promoted to vice-president and treasurer, retaining that position when the San Diego system became independent in 1941. Succeeding Mr. Fowler as treasurer is J. M. BOURUS, formerly general auditor, who joined the company in 1918. Previously he was associated with the Oklahoma Gas & Electric Co. RAY C. CAVELL, head of the engineering department, has been made secretary. Mr. Cavell joined the San Diego company in 1914.

•

Head Made Chief Engineer of Wisconsin Utility

James A. Tyvand, chief engineer, Wisconsin Gas & Electric Co., Racine since 1938, has resigned effective July 1, to accept a position as associate with Parsons, Brinkerhoff, Hogan & Macdonald, consulting engineers in New York. Guerdon H. Head, gas engineer of the Racine utility for the past four years, will succeed Mr. Tyvand as chief engineer.

Mr. Head has been associated with the Racine utility continuously for the

G. H. Head

past 22 years. He began his association with Wisconsin Gas & Electric Co. in 1923, one year after his graduation from the University of Wisconsin. He has served successively as student engineer, industrial gas engineer and gas engineer.

Mr. Tyvand entered the public utility field with the Wisconsin Electric Power Co. in 1924. After a connection with the Chicago, Milwaukee, St. Paul and Pacific Railroad, he returned to the Milwaukee utility, where he remained until 1929 when he became system engineer of Wisconsin Gas & Electric, a position he relinquished in 1936 to become associated with the Iowa Farm Bureau Federation in the design of REA lines. Rejoining Wisconsin Gas the following

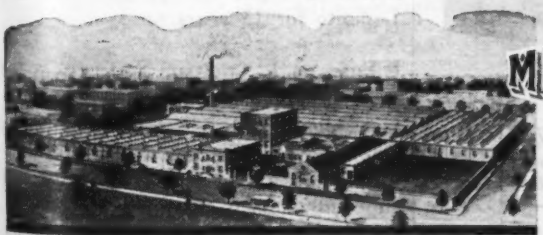
3 of the 18 METROPOLITAN ELECTRICAL UNITS IN THE LINCOLN TUNNEL

Complete Electrical Control by

At the right are listed various types of electrical control equipment designed and furnished by METROPOLITAN for utilities, industrial plants, large mercantile establishments, and public buildings. Your inquiries are invited.

Knife Switchboards
Circuit Breaker Switchboards
Dead Front Switchboards
Battery Charging Switchboards
Motor Control Switchboards
Explosion-proof Switchboards
Laboratory and Test Switchboards
Control Switchboards
Generator and Distribution Switchboards

METROPOLITAN ELECTRIC MFG. CO.



ESTABLISHED 1892
METROPOLITAN
TRADE MARK
ELECTRIC LIGHTING AND POWER DISTRIBUTION EQUIPMENT

GENERAL OFFICES: LONG ISLAND CITY, N. Y. FACTORIES: LONG ISLAND CITY, N. Y., & WEST WARREN, MASS.

MECHANICAL GUARDIANS FOR ALL KINDS OF PIPE LINES

In chemical industries, synthetic rubber plants, oil refineries . . . any plant, piping precious or potentially hazardous fluids . . . a mistake, whether unintentional or deliberate, in adjusting a pipeline valve can prove both dangerous and costly. But prevention of these human errors is easy and infallible with BENDIX-CORY* SAFETY INTERLOCKS . . . the locks that say "No!" to unauthorized handling of your valves.

The BENDIX-CORY SAFETY INTERLOCK illustrated gives absolute control over the opening and closing of the valve to which it is attached . . . and, by use of an interlock key, can also control the position of this valve in relation to any number of other valves. The unit is wholly mechanical, and fully adjustable to compensate for valve wear—one of a number of interlocks specially designed for valve protection.

BENDIX-CORY SAFETY INTERLOCKS are dependable guardians for your pipelines. Write for full information.

*REG. U.S. PAT. OFF.

CHECK THESE FEATURES

- ✓ Interlocks stem valves 2" to 8". Other interlocks for globe, lead and porcelain valves.
- ✓ Absolute control of valve opening and closing under all conditions.
- ✓ Positions valve in relation to other valves.
- ✓ Ample strength characteristics.
- ✓ Indoor or outdoor installation without removing valve from service.
- ✓ Fully mechanical. No electric circuit.
- ✓ Position indicator (not shown) shows valve open or closed.
- ✓ Adjustable compensation for valve wear.

Bendix-Marine INSTRUMENTS CONTROLS

PRODUCT OF Bendix AVIATION CORPORATION

MARINE DIVISION
BENDIX AVIATION CORPORATION
106 NOSTRAND ST., BROOKLYN 5, N. Y.

year as electrical engineer, he became chief engineer in 1938, succeeding S. B. Sherman, now vice-president and general manager.

•

R. D. McManigal Assumes New Executive Duties

Robert D. McManigal, manager of Westinghouse Electric International Co.'s associated companies department since 1940 with offices in New York, has been elected a vice-president of the company.

Mr. McManigal joined the Westinghouse Electric Corp. at Pittsburgh in

R. D. McManigal

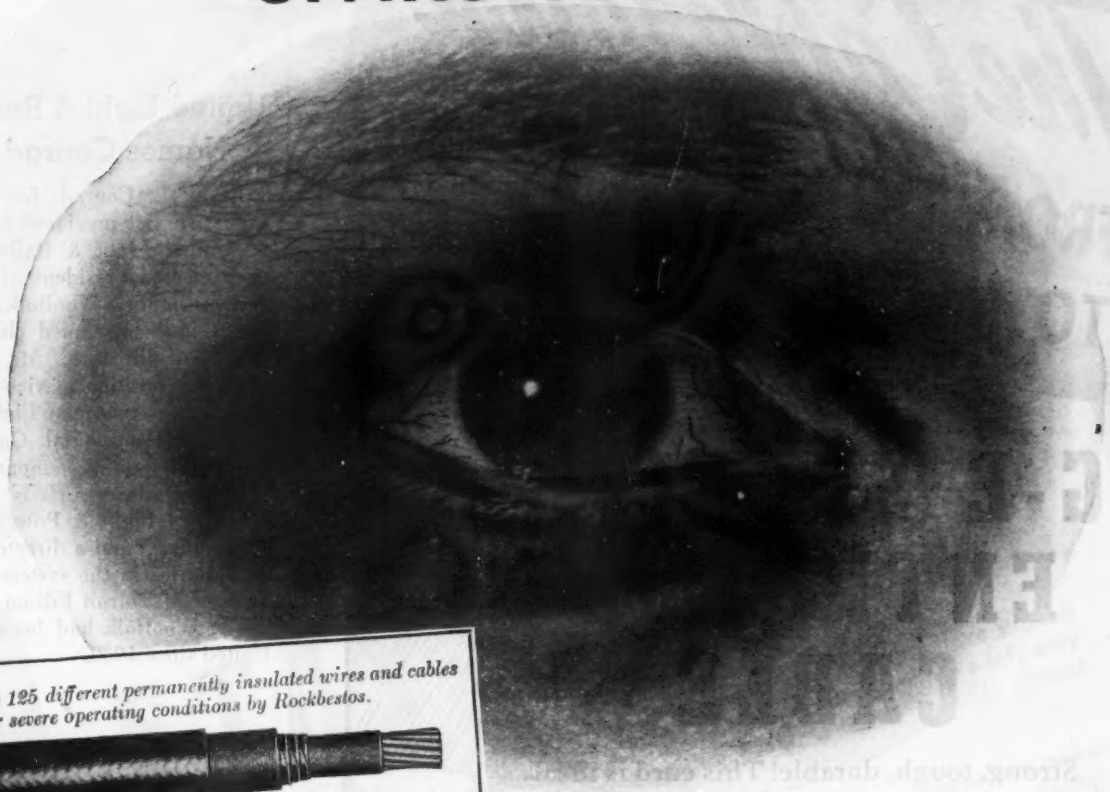
1915 as a member of the graduate student course. In 1922 he was sent to Japan as an engineer for the Westinghouse Electric International Co., and later served as managing director of the Westinghouse Electric Co. of Japan until that company's dissolution in 1931, when he returned to New York. Since 1931, Mr. McManigal has been successively, manager of the central station-transportation apparatus department, assistant to the vice-president, and finally manager of the associated companies department.

•

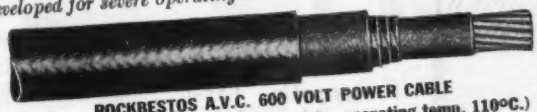
▶ EARL WALDEN has been appointed manager of the Craighead Electric Cooperative Corporation, Jonesboro, Ark., to succeed T. J. Robertson, resigned. Mr. Walden was manager for the Arkansas Power & Light Co. at Trumann and Lepanto for 15 years.

▶ EDMUND J. THIMME, assistant to the division superintendent, Passaic Division, electric distribution department, Public Service Electric & Gas Co., Newark, N. J., has been appointed division superintendent in that division, succeeding GEORGE S. CURTIS, who retired after 55 years of service with Public Service

ARE WIRE-FAILURES GIVING YOU A BLACK EYE?



A few of the 125 different permanently insulated wires and cables developed for severe operating conditions by Rockbestos.

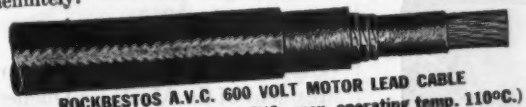


ROCKBESTOS A.V.C. 600 VOLT POWER CABLE

(National Electrical Code, Type AVA—max. operating temp. 110°C.)

Sizes No. 18 AWG to 2,000,000 CM insulated with felted asbestos and varnished cambric, and covered with an asbestos braid. Other constructions for service voltages up to 5000.

This cable is recommended for power circuits and hot-spot wiring in or around boiler rooms, ash pits, steam tunnels, soaking pits, tenter frames, glass plants, steel mills, etc. The asbestos and heat-sealed varnished cambric construction has ample moisture resistance and withstands high temperatures indefinitely.



ROCKBESTOS A.V.C. 600 VOLT MOTOR LEAD CABLE

(National Electrical Code, Type AVA—max. operating temp. 110°C.)

Sizes No. 18 AWG to 1,000,000 CM insulated with two walls of felted asbestos and a high-dielectric varnished cambric insert, with a heavy asbestos braid overall.

Heatproof, fireproof, greaseproof and oilproof, this cable will not dry out and crack, won't burn or carry flame, and will remain permanently flexible. For coil connections, motor and transformer leads where overloads, extreme heat and fire hazards are encountered as in steel mills, boiler rooms, etc.

ROCKBESTOS A.V.C. 600 VOLT CONTROL CABLE

In one to 19 conductors with individuals insulated like Motor Lead Cable, cotton braid covered, and cabled with an asbestos braid over all. Standard strandings AWG No. 12—19/ #25 and No. 9—19/ #22. Other strandings on order.

Designed for use under conditions too severe for control cables with other types of insulation which deteriorate rapidly when exposed to high temperatures. Operates without failure under the attack of heat, oil, grease or corrosive fumes and may be installed in conduit as it has ample moisture resistance.

Is your producing machinery missing in action too often because power leads are failing under insulation-baking overloads? Are heat-weakened control circuits causing too much time-out? Do oil-soaked motor leads give up just when everything should be humming?

Then you're due to go in for some wire-failure elimination with Rockbestos A.V.C. *permanently insulated* wires and cables . . . built to take the heat up to 230°F. without drying out, cracking or flowing under the baking . . . and without rotting or blooming when exposed to oil, grease, alkalies or corrosive fumes.

For failure-free circuits install Rockbestos A.V.C. alongside blistering steam lines and kilns, in thermometer-boosting boiler rooms and tunnels, and around forging presses, soaking pits and steel mill furnaces . . . in fact, anywhere that other wires are kicking out too often.

Send for our catalog showing a complete line of *permanently insulated* Rockbestos wires, cables and cords, including many of the 125 standard constructions and National Electrical Code types we designed for failure-prevention. Write to the nearest district office or:

ROCKBESTOS PRODUCTS CORPORATION
998 Nicoll St., New Haven 4, Conn.

ROCKBESTOS A.V.C.

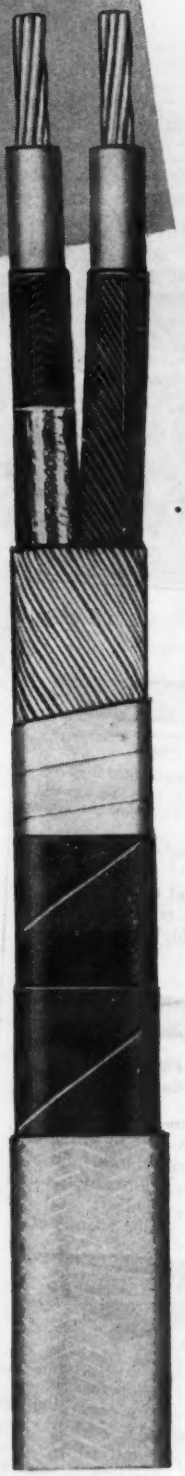
The Wire with Permanent Insulation

FOR VICTORY . . . BUY WAR BONDS

NEW YORK BUFFALO CLEVELAND CHICAGO PITTSBURGH ST. LOUIS LOS ANGELES SAN FRANCISCO SEATTLE PORTLAND, ORE.

The Cable to Use

FROM ENTRANCE CAPS TO METER EQUIPMENT



TYPE SE

G-E SERVICE ENTRANCE CABLE

Strong, tough, durable! This cord is ideal for service entrance wiring on homes, stores, garages and small buildings of all kinds. It is especially suitable for service wiring on farm buildings and farm meter poles. It can be installed directly on the outside of buildings without conduit protection. This cable can be used to advantage in range circuits too.

G-E service entrance cable is available in sizes 12 to 2. Cable assemblies consist of one or more Type R insulated conductors and a concentrically-applied stranded bare conductor. This cable is flexible and can be bent edgewise without damaging the conductors. A heavy watertight, weatherproof over-all covering protects the conductors. (Similar cable is available with steel armor under the outer covering. G-E Type SD cable is also offered for overhead use from pole to building.)

FOR FURTHER INFORMATION see the nearest G-E Merchandise Distributor or write to Section C752-9, Appliance and Merchandise Department, General Electric Co., Bridgeport, Conn.

BUY WAR BONDS AND HOLD THEM

GENERAL ELECTRIC

and predecessor companies. JOSEPH J. GLATZEL, division substation engineer, central division, electric distribution department, has been named assistant division superintendent in the Passaic Division.

•

United Light & Railways Names Conrad President

Frank L. Conrad, for several years executive vice-president and a director of United Light & Railways Co., has been elected president of the company and William G. Woolfolk, former president, has been named chairman of the board of directors. Mr. Conrad also holds the position of vice-president and director of American Light & Traction Co. and Continental Gas & Electric Corp., sub-holding companies of United Light & Railways. He is also president of United Light & Power Service Co., a subsidiary, and a director of six other subsidiaries in the system, as well as a director of Detroit Edison Co.

Mr. Woolfolk had been president of United since 1939.

•

►L. P. DENDEL, assistant secretary, Michigan Millers Mutual Fire Insurance Co., Lansing, has been elected president of the International Association of Electrical Inspectors. Mr. Dendel has been active in IAEI for many years, being a member of the executive council since its organization and having served as president of the western section in 1938-39. He was president of the Michigan Association of Electrical Inspectors in 1933.

►A. ROY MACLAREN has been appointed president of the Maclaren-Quebec Power Co. and vice-president of the James Maclaren Co., Ltd., to succeed T. F. Kenny, who died on May 21. A. BARNET MACLAREN was appointed president of the James Maclaren Co., Ltd., and vice-president of the Maclaren-Quebec Power Co., succeeding in these positions Robert M. Kenny, brother of T. F. Kenny, who died on April 26.

►KENNETH B. ALDRICH, transmission development chief of the Bonneville Power Administration, has been loaned to the United States Department of the Interior, power division, to conduct market and transmission studies in connection with generating plants authorized for construction in eastern states.

►N. C. THOMPSON, Jasper district superintendent of the Alabama Power Co. since 1941, has been transferred to the distribution department, Birming-

Seal High Pressure Lines This Modern Way . . . and they STAY SEALED!

NO LEAKAGE . . . for 33 years, Flexitallic spiral-wound Gaskets have proved their ability to handle joint sealing problems that other gasket types have left only partially solved. There is no high-pressure gasket problem that Flexitallic cannot solve better and cheaper in the long run!

NO BOLT STRESS PROBLEMS . . . the unique Flexitallic construction makes the joint semiflexible, thus compensating for shocks and sudden line stresses. Centering and gasket yield are balanced with joint bolting and service requirements are minimized.

NO VIBRATION WORRIES . . . flexitallic Gaskets automatically adjust themselves to meet changing or adverse conditions such as vibration, expansion, contraction, etc. On the most exacting wartime jobs, Flexitallic has successfully met one emergency after another — after other gasket types failed.

CHEMICAL PROBLEMS . . . gaskets of special non-contaminating materials represent only one of the many Flexitallic types regularly produced. Whatever your gasket requirement, Flexitallic can match it!

NO MAINTENANCE . . . besides reducing gasket maintenance to a minimum on high-pressure or high temperature applications, Flexitallic holds widespread possibilities for low-pressure use. A slightly higher first cost can mean a lifetime of trouble-free service!

Made in a complete line for extreme temperature and/or pressure ranges for pipe flanges and pressure vessels including boiler manholes, handholes, waterwalls, superheaters, economizers, Diesel and gas engines, pumps, etc. Write for catalog.

"Flexitallic"

REG. U. S. PAT. OFFICE

FLEXITALLIC GASKET COMPANY

8th & BAILEY STREETS • CAMDEN, NEW JERSEY

SAFE, SURE SEALING FOR HIGH-PRESSURE APPLICATIONS

Clean INSTRUMENTS

in the **L&R INDUSTRIAL PRECISION CLEANING MACHINE**

Equipment also used to Clean · Rinse · Polish · Dry meters, jewels, crystals, radio tube parts, timing mechanisms and related units. Work basket measures 5½" ID x 3⅜" deep. Used by Army, Navy, airlines, over 400 industries, utilities, municipalities. Write for complete catalog data.

Clean BALL BEARINGS

in the **L&R Precision Ball Bearing CLEANING MACHINE**

For bearings measuring up to 2" OD. Machine combines famous rotary principle with new pressure cleaning mechanism to turn out scrupulously clean ball bearings. Used by Navy, major industries. Write for complete catalog data.

L&R MANUFACTURING COMPANY
577 Elm St., Arlington, N. J. • Chicago 2, Ill.

Now! Send for this Bulletin!

Use Coupon below or write on your letterhead!

See how you save time ...save money, *with New Stewart* CABLE TESTER & LOCATOR

Combined

Tells exactly where cable or pipe is buried, and correct depth.

- Finds old cable, or pipe when records have been lost.
- Locates path of service pipe or cable to building.
- Locates position of water main in street or alley.
- CHECKS CABLE AT RIVER CROSSINGS.
- Determines if pipe is below frost after lowering or grading street.
- Maintains absolute level. Withstands rough use and weather. Lamp circuit checks all connections after test setup.

Combines all above advantages with the famous Stewart Cable tester for locating shorts, crosses, grounds and wet spots in cables above, below, anywhere.

W. C. DILLON & CO., Inc. 5423 West Harrison Street, Chicago, Ill.
Manufacturers, Engineers, Research Development since 1895

PRICED LOW Send coupon NOW for full descriptive data

W. C. DILLON & CO., Inc.
5423 W. Harrison St., Chicago 49, Ill.
Send Bulletin on CABLE TESTER & LOCATOR.

Name .....
Position .....
Firm or office .....
Address .....
.....

ham, as senior engineer. Mr. Thompson has been identified with Alabama Power Co. since 1928 and previously had been with the Utica Gas & Electric Co. and Syracuse Lighting Co.

•

New Division Managers Appointed by Utility

Announcement has been made by the Northern States Power Co., Minneapolis, Minn., of a number of changes in division managerships of the company.

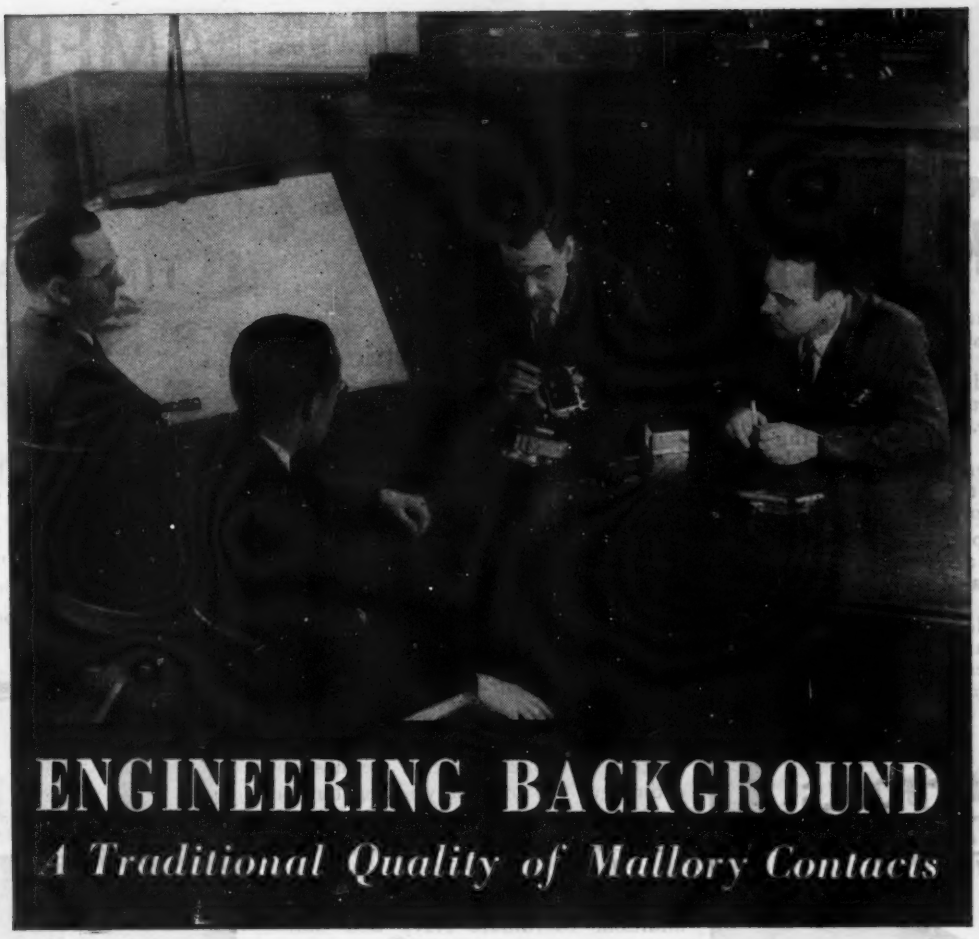
G. O. House has retired from active management of the St. Paul division after having served the company in that capacity since 1918. Mr. House will continue in an advisory capacity. J. F. McGuire, manager of the Fargo division, has succeeded Mr. House. Mr. McGuire has been in Fargo since 1923 and has been affiliated with the Northern States organization since 1909. Allen S. King, division manager at Grand Forks, has succeeded Mr. McGuire at Fargo. Mr. King started working for the company while attending college and upon graduation in 1922 was permanently employed. C. B. Ayars, manager of the Northern States Power Co. of Wisconsin at Sparta, has succeeded Mr. King.

Wheelock Whitney has retired as manager of the St. Cloud Division, and has been succeeded by E. K. Thorgaard, management representative at Glenwood. Mr. Whitney had been manager of the St. Cloud division since 1924, when the St. Cloud Public Service Co. was acquired by the Northern States Power Co. Mr. Thorgaard has been connected with Northern States since 1923.

•

► PAUL S. CLAPP, vice-president of the Columbia Gas & Electric Corp., Columbus, Ohio, was awarded the Anson Marston Medal by Iowa State College at the graduation exercises held recently in Ames, Iowa. Award of the Marston Medal is made annually to the engineer alumnus of Iowa State College whose achievement in the professional world has been such that it merits special recognition.

► C. E. MASON has been appointed technical director of the Bristol Co., Waterbury, Conn. Following World War I, Mr. Mason practiced consulting engineering in Tulsa until 1925 and in this period of time he specialized in automatic control problems. From 1925 until 1941 he was associated with the Foxboro Co. and for several years served as director of control research. From 1940 until joining the Bristol Co. he was director of engineering of the Mason-Neilson Regulator Co. In 1940



ENGINEERING BACKGROUND

A Traditional Quality of Mallory Contacts

WITH 22 years of engineering experience in developing improved alloys and materials for contact applications—in designing all types of contacts and contact assemblies—and manufacturing them with precision—Mallory is ready to supply electrical contacts or contact assemblies with the extra measure of quality that assures improved performance in your equipment. During this period, over 5,000 designs have been developed by Mallory engineers to establish a wealth of contact "know how."

The *design* best adapted to your contact application is manufactured by Mallory from the most suitable *materials* . . . for Mallory provides contacts of tungsten, silver, platinum, Elkonite*, Elkonium* and other Mallory alloys in various combinations. Whether you want complete contact assemblies, individual contacts, or contacts attached to brackets, springs, studs, or arms Mallory has the facilities for a large production run or a small order.

Manufacturers of relays, industrial controls, circuit breakers, business machines, home appliances and other electrical and electronic equipment rely on Mallory—Contact Headquarters. Make it a policy to consult Mallory engineers *before* your designs are blueprinted.

P. R. MALLORY & CO., Inc., INDIANAPOLIS 6, INDIANA

*Reg. U. S. Pat. Off. for electric contacting elements.

STURD-E GUARDED

PIKE POLE

● The automatic guard adds immeasurably to the safety of this pole—the point is covered when not in use—completely guarded against damage. When in use, the tubular sleeve slides back and reenforces the head, adding to the service life of the pole.

The spike is forged from best quality steel, heat treated and tempered for long life. Handles are select fir—sanded and lacquered—lengths regularly furnished ten to twenty feet. For maximum service life, economy, and value, specify

STURD E TOOLS
a TRUE TEMPER PRODUCT

Automatic Tubular Pike Pole guard is shown in the phantom view above. Extremely simple in operation, it gives positive protection to the point of the pike.

Distributed by
JOSLYN MFG. & SUPPLY COMPANY
Executive Offices
20 North Wacker Drive • Chicago, Illinois
Branches and Warehouses with Complete Stocks in Principal Cities of the United States

he received from the National Association of Manufacturers an award as one of the country's Modern Pioneers for his accomplishments in the field of automatic control. Active in the affairs of the American Society of Mechanical Engineers, he has written many papers on the basic principles of automatic control, which have been published in the technical press.

•

Westinghouse Electric Assigns New Duties

Recent appointments by the Westinghouse Electric Corp. included Charles E. Young, former supervisor of economic research, who was named manager of the newly created statistical research department.

Gerard H. Welch has been appointed assistant to the manager of the switchgear and control division, Pittsburgh. Mr. Welch joined Westinghouse in 1922 and has been assistant manager of switchboard engineering since last August, in which position he has coordinated the company's negotiation, engineering and production activity on Navy switchboards and similar material. In his new capacity, he will continue to direct that program, and in addition, coordinate Navy and Maritime control, commercial control and other important contracts.

Lee C. Bennett has been appointed central station manager of the Middle Atlantic District. Mr. Bennett will also retain the position of marine manager for that district and his headquarters will continue to be in Philadelphia.

The appointment of Patrick W. Cross as manager of the Sao Paulo office of Westinghouse Co. of Brazil and the assignment of W. W. Parker as regional engineer in the Rio de Janeiro office, have been announced by Westinghouse International Co. Mr. Cross has been with Westinghouse since 1934 and Mr. Parker since 1927.

John A. Vassar has been made general service manager of the Westinghouse Electric Supply Co., with offices in New York. In his new position, he will be responsible for the company's nation-wide service department operations, including home appliances and radios. Mr. Vassar joined the Westinghouse Electric Corp., parent of the Supply Company in 1929. Another Supply Company appointment was that of R. H. Elliott as district apparatus and supplies manager with headquarters in Philadelphia.

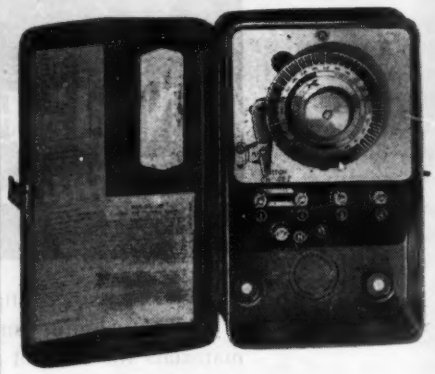
•

► CARL C. CRANE has resigned as chief engineer of the Wisconsin Electric Cooperative, to enter the consulting engineering field in Madison, Wis. A grad-

AMERICA'S "TOPS" IN TIME SWITCH PERFORMANCE

Mr. "Tops," the Paragon symbol of top quality

. . . an accurate, durable self-lubricating time switch for controlling stokers, oil burners, blowers, pumps, valves, air conditioning, etc. . . . . for only $13.00 list.



JUST TWO EXPOSED GEARS. All others constantly lubricated because they operate in a sealed oil bath.

DUST PROOF. Because of the sealed-in features, dust has no effect upon the operation.

SLOW SPEED MOTOR. The first and only low priced Time Switch to be timed and operated by slow speed (450 R.P.M.) industrial type self-starting synchronous motors.

FOR LOW TEMPERATURE. Guaranteed to operate successfully at temperatures as low as 20 degrees below zero.

SELECTION OF SWITCHES. Switches available: single pole single throw, double pole single throw or single pole double throw.

Send for complete engineering bulletin. Paragon manufactures a wide range of industrial timers, time delay relays, panel boards and other electrical equipment.

PARAGON ELECTRIC COMPANY
703 OLD COLONY BUILDING
CHICAGO 5, ILLINOIS

Paragon Chicago
BUILDERS OF ELECTRICAL EQUIPMENT SINCE 1905

FOR THE TOUGH JOBS

Continental-Diamond
Engineered Dielectric Materials

A grade LE DILECTO laminated plastic insulating part used in rocket controls. Its insulating properties and dimensional accuracy must remain stable under terrific impact and vibration and regardless of temperature extremes.

THE ability of C-D DILECTO Electrical Insulation to take all a rocket can give . . . and still function perfectly . . . is good evidence that C-D DILECTO will serve well as electrical insulation in your present and future products.

C-D DILECTO is made in many standard grades to meet specific electrical, physical and thermal problems. Special grades can be developed to meet unusually exacting conditions. C-D DILECTO may be the solution to your "What Material?" problem.

KR-45

C-D PRODUCTS

The Plastics

DILECTO—A Laminated Phenolic.
CELORON—A Molded Phenolic.
DILECTENE—A Pure Resin Plastic Especially Suited to U-H-F Insulation.
HAVEG—Plastic Chemical Equipment, Pipe, Valves and Fittings.

The NON-Metallics

DIAMOND Vulcanized FIBRE
VULCOID—Resin Impregnated Vulcanized Fibre.
MICABOND—Built-Up Mica Electrical Insulation.

Standard and Special Forms

Available in Standard Sheets, Rods and Tubes; and Parts Fabricated, Formed or Molded to Specifications.

Descriptive Literature

Bulletin GF gives Comprehensive Data on all C-D Products. Individual Catalogs are also Available.

DISTRICT OFFICES
NEW YORK 17 • CLEVELAND 14 • CHICAGO 11
SPARTANBURG, S. C. • SALES OFFICES IN PRINCIPAL CITIES

WEST COAST REPRESENTATIVES
MARWOOD LTD., SAN FRANCISCO 3

IN CANADA:
DIAMOND STATE FIBRE CO. OF CANADA, LTD., TORONTO 8

Continental-Diamond FIBRE COMPANY

Established 1895 . . Manufacturers of Laminated Plastics since 1911—NEWARK 15 • DELAWARE

HE SWORE HE WOULDN'T SHAVE TILL HE FOUND A ROLL OF GOLD SEAL TAPE THAT PEELED!

Small chance of ever finding a roll of Gold Seal Tape that peels . . . dries out . . . smears . . . or ravels. Jenkins lab-tests everything . . . base cloth, compound . . . controls production every step of the way. What is more, Jenkins cellophane wraps – then boxes – every roll to make doubly sure Gold Seal reaches you factory-fresh! Jenkins Bros., Rubber Division, 80 White Street, New York 13, N. Y.

Jenkins Bros. also makes Diamond Seal Friction and Rubber Tapes which meet ASTM and Federal specifications.

JENKINS *Gold Seal Tapes*

FRICTION .. RUBBER

For the RIGHT Brush Prescription Call in a SPECIALIST

You can depend on SPEER Carbon Brushes to perk up d-c and slip-ring motors and generators because every SPEER Brush is matched—mechanically and electrically—to the service characteristics of the machine it's sold to serve.

In the Matched Dependability of SPEER Brushes you get utmost freedom from burning, overheating, sparking, excessive wear and energy losses, and other brush troubles that decrease operating efficiency, cause extra maintenance.

You save time and avoid the possibility of brush "misfits", when you take advantage of SPEER'S nearly 50 years' specialization in fitting brushes to machines. From its all-inclusive line of standard and special carbon, graphite, electro-graphite and metal-graphite brushes, SPEER can supply the grade that will deliver peak performance, fewer brush renewals and less maintenance on any application.

For brushes matched to *your* motors, call on SPEER—write direct for Brush Data Forms.

SPEER
CARBON COMPANY
ST. MARY'S, PA.

CHICAGO • CLEVELAND • DETROIT
MILWAUKEE • NEW YORK • PITTSBURGH

7384

uate of the University of Michigan, Mr. Crane has spent most of his time in the design and construction field with various public utilities. In 1938 he joined the staff of the Federal Power Commission, and in 1942 he was assigned to the inventory control branch of the Office of War Utilities. The following year he returned to the power section of the Federal Power Commission.

▶ MAX J. SCHINKE has been appointed service manager for all products of the Admiral Corp., Chicago. Mr. Schinke formerly held this position with Stewart-Warner Corp. Admiral acquired the appliance division of the Stewart-Warner Corp. in 1944. Mr. Schinke is chairman of the service committee of the Radio Manufacturers Association.

OBITUARY

▶ B. G. ERSKINE, chairman of the board of directors and former president of Sylvania Electric Products, Inc., died suddenly at his home in Emporium, Pa., on June 23. Mr. Erskine was one of the pioneers of the radio tube industry. In 1931 he merged his interests with those of Frank and E. J. Poor, founders of the Hygrade Lamp Co., to form the present Sylvania Electric Products, Inc. Mr. Erskine was 62 years of age.

▶ JOHN J. KIRKPATRICK, 79, manager of the Holyoke (Mass.) municipal gas and electric department since 1913 and one of the most widely known public utility executives in the public ownership field, died at the Providence Hospital in Holyoke on June 25. He was born in South Hadley Falls, Mass., and was educated at McGill University, Montreal, Canada, as a civil engineer. He became city engineer of Holyoke in 1898 and was later superintendent of the water department.

▶ FRANK T. DOWD, 54, executive assistant in the central district of the New England Power System with headquarters at Leominster, Mass., died at Camp Edwards Hospital, Mass., after having been taken ill at Falmouth. He was a native of Worcester, Mass., and for some time was identified with rural electrification work in central Massachusetts, having also been connected at various times with the Narragansett Electric (Providence), Webster & Southbridge, and Gardner, Mass., companies.

▶ JAMES GARFIELD GIRLING, West Hartford, Conn., general superintendent of Arrow-Hart & Hegeman Electric Co., Hartford, for 35 years, died June 15. Mr. Girling was a native of St. Albans, Vt.

copy-cats!

. . . by special request

Somewhere on the Western front, the retreating Germans left behind their strategic telephone communications system—all intact—*except that every vacuum tube had been removed from the repeaters.*

The Signal Corps went to work speedily to restore this valuable system for our own use. An engineer who had worked under the Germans supplied some general notes on the system and its operation. One tube believed to be of the missing type was found. Notes and tube were rushed to the U. S. by air.

At Bell Labs, tests and X-rays revealed the tube's inner construction and electrical characteristics and proved that no similar tube was available in this country. The German tube differed also in dimensions of the bulb and base and in the arrangement of the pins. Hurried consultations and calculations indicated that a suitable tube could be built from existing parts of American tubes—except for a grid and the base.

At Western Electric, the tube shop went to work—modified machines to wind the grid, and in three days produced eight tubes with hand-made bases, which were flown to Europe for trial in the system. Meanwhile, production went ahead at top speed and just 17 days after the lone German tube was received at Bell Labs, 1,015 duplicates of it had been completed. Result: the Signal Corps soon had the German telephone system in operation again.

Bell Labs and Western ordinarily wouldn't be happy about copying *anybody's* products. We developed the first repeater tubes—which later led to trans-Atlantic telephony and radio broadcasting. It has long been our tradition to create our own superior designs. Working together, Bell Labs and Western have solved many of the war's toughest electronic problems. After the war, count on this team for continued leadership in communications equipment.

BELL TELEPHONE LABORATORIES

Exploring and inventing, devising and perfecting for our Armed Forces at war, and for continued improvements and economies in communications.

Western Electric

Manufacturing team-mate of Bell Labs, and the country's largest producer of communications and electronic equipment for war.

MANUFACTURING MARKETS

More Refrigerators, Washers Scheduled

WPB has granted priorities assistance to nine manufacturers of domestic mechanical refrigerators and to twelve producers of domestic washing machines for the production of 227,709 refrigerators and 155,797 washers in the third quarter.

Within the next few weeks, it will grant priorities for the production of 37,291 additional refrigerators and 194,403 more washers in the same quarter, bringing up to authorized strength the programs for which WPB will guarantee materials next quarter.

Authorizations, carrying AA-3 priorities with them, were assigned as follows:

Frigidaire Division, General Motors Corp., Dayton, Ohio, 56,445 units; General Electric Co., Erie, Pa., 47,501; Nash Kelvinator Corp., Grand Rapids and Detroit, Mich., 27,825; Seeger-Sunbeam, Evansville, Ind., and St. Paul, Minn., 25,639; Servel, Inc., Evansville, Ind., 20,272; Norge Division, Borg-Warner Corp., Muskegon, Mich., 14,369; Westinghouse Electric Corp., Mansfield and Springfield, Ohio, 21,068; Philco Corp., Connorsville, Ind., Chicago, Ill., and Tecumseh, Mich., 12,090; Ranney Refrigerator Co., Greenville, Mich.; Sidney, Ohio, and Tecumseh, Mich., 2,500.

Washer authorizations, carrying the same rating, were as follows:

Nineteen Hundred Corp., St. Joseph, Mich., 38,821 units; General Electric Co., Bridgeport, Conn., 18,430; Bendix Home Appliances, Inc., South Bend, Ind., 18,000; Automatic Washer Co., Newton, Ia., 6,700; Dexter Co., Fairfield, Ia., 6,400; Appliance Mfg. Co., Alliance, Ohio, 4,900; Zenith Machine Co., Duluth, Minn., 4,200; One Minute Washer Co., Kellogg, Ia.; 3,200; Westinghouse Electric Corp., Mansfield, Ohio, 3,200; The Maytag Co., Newton, Ohio, 38,504; Norge Division, Borg-Warner Corp., Detroit, Mich., 7,842; Landers, Frary and Clark, New Britain, Conn., 5,600.

•

Issues Battery Manual

A summary of information on all the various industrial applications of storage batteries has just been issued by the Storage Battery Division of Philco Corp. The new manual includes a wide range of battery facts running all the way from the proper method of operating and maintaining batteries in the tropics to how best to preserve the life of a battery when not in use. The contents are grouped in three main sections, motive power batteries, stationary batteries and battery maintenance and export data.

•

Battery Welders Certified by AAF for Aluminum

Official certification of the dependability of the new battery-powered resistance welding equipment for the spot welding of aluminum sheet has been issued by the Army Air Forces Air Technical Service Command according to advices from Progressive Welder Co., Detroit.

Prior to issuing certification (#RW-185-P-2) tests were conducted on welding of 24 ST Alclad in the various gage combinations. Welding tests were performed on a Progressive rocker arm type aluminum welding machine, powered by a 16 cell storage battery power-pack.

The certification was issued in connection with authorization to use the equipment for the assembly welding of wing flaps for P-38's on battery powered welding machines.

•

Water Heater Standards Get Southeast Approval

Ninety percent of the utilities which are members of the Southeastern Electric Exchange have approved the National Electrical Manufacturers Association standards for tank size and element wattages of electric water heaters to be sold for connection on their lines.

The standards are as follows:

Two unit heaters, 30 gallons or larger —20 watts per gallon for bottom unit and 30 watts per gallon for upper unit; single unit heaters 50 watts per gallon.

•

Will Call 3½% Bonds

General Cable Corp. directors have voted to call for redemption July 16 all the outstanding Series C 3½ percent bonds at a total redemption cost of $3,054,500.

Big New G-E Orders Offset Cut-Backs

Termination of war contracts held by the General Electric Co., while proceeding at a substantial rate, has left few gaps in the company's overall business because of the large volume of new orders that has been received, Charles E. Wilson, president of the company, has announced.

In 1944, G-E war contracts, held either as a prime contractor or as a subcontractor, were terminated by cancellations or cutbacks at an average rate of $32,000,000 a month. In the first five months of 1945 the monthly average of terminations has been only $23,000,000, with March and May up to last year's average and the other months substantially below it.

Mr. Wilson pointed out that orders received in 1944, largely for war products, totalled $1,609,636,000, and that orders for the first five months of 1945 total $598,481,000. In each period, the new orders have exceeded the billing for the period, and thus for the company as a whole have filled the gaps left by cancellations and cutbacks.

Most of the shrinkage of employment since the peak on Dec. 31, 1943, when 175,290 were employed on G-E war work, has been due to employees entering military service or leaving for personal reasons, and has not been caused by termination of contracts resulting in layoffs. The employment figure for March 31 of this year was 153,685.

Mr. Wilson pointed out that the effect of cancellations and cutbacks to date has not been to relieve critical labor shortages at General Electric, particularly with regard to the more highly trained engineers, technicians, designers, and skilled workmen such as toolmakers and all-around mechanics. Common labor also is still almost impossible to obtain.

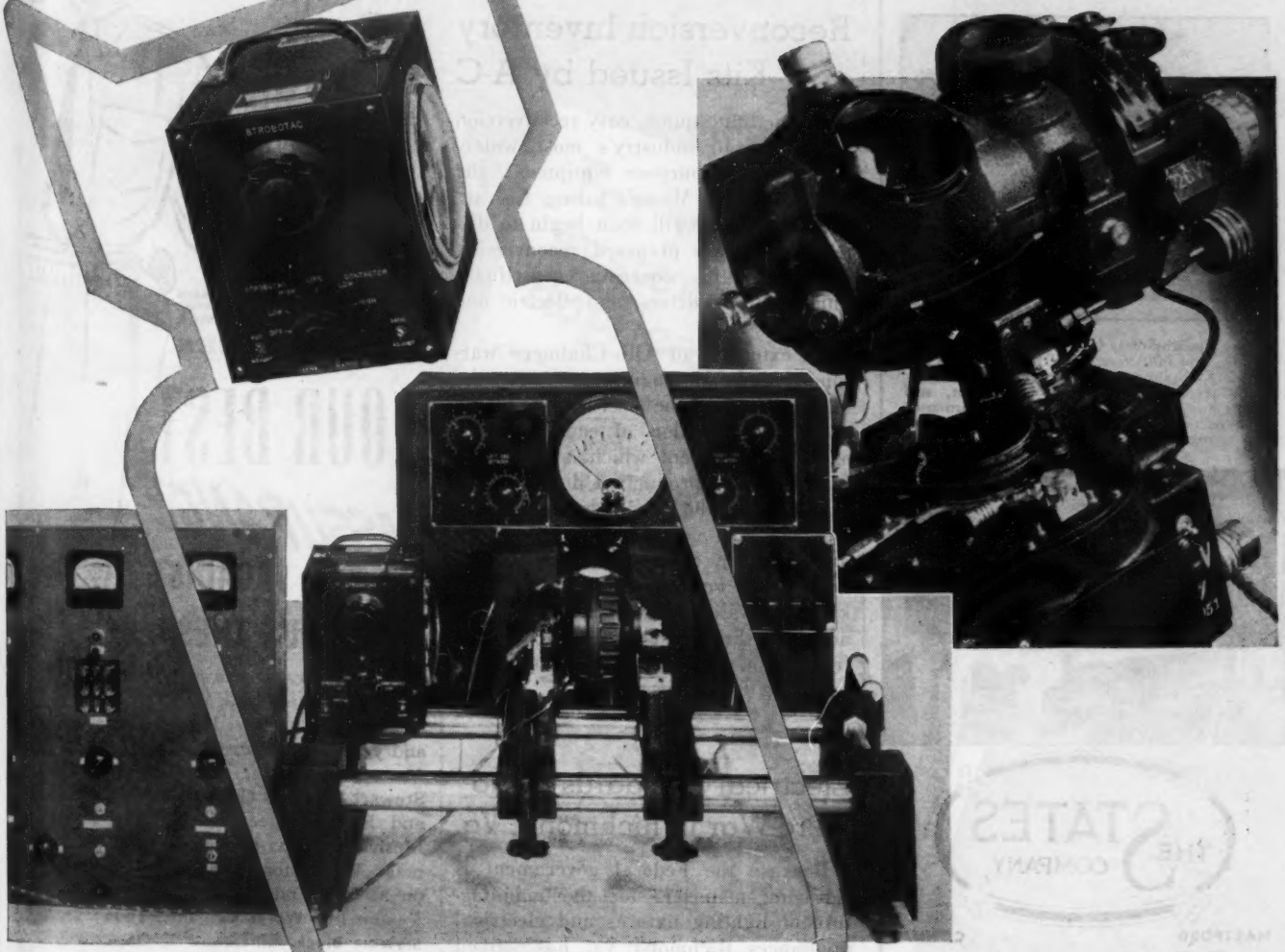
•

Eureka Co. Will Absorb Williams Oil-O-Matic

Stockholders of the Eureka Vacuum Cleaner Co. have approved a plan for the absorption of the Williams Oil-O-Matic Heating Corp., Bloomington, Ill., after stockholders of the latter company, meeting in Bloomington, also approved the merger.

The two companies will be merged into a single corporation, and will operate as two divisions of the Eureka Vacuum Cleaner Co. H. W. Burritt, Eureka president, will continue as head of the enlarged company, while William A. Matheson, president of Williams, will

PRECISION *to 0.000070 Inch!*



● One of the mechanical marvels of the war is the famed Norden Bombsight, until recently one of the most secret of military devices. Information on some of its general features has now been released by the Army.

This bombsight is probably the most precise instrument in the world, yet it is being built in mass production by the Victor Adding Machine Company and several other manufacturers.

The heart of the bombsight and its associated stabilizer are two gyros which have to be balanced to almost unheard-of accuracy. When inspected, the rotor must be centered to *70 millionths of an inch.*

To obtain this accuracy, each gyro is carefully adjusted on the balancing machine shown in the illustration. This portable unit is manufactured by the Gisholt Machine Company. General Radio's STROBOTAC is a part of this machine.

The control equipment at the left includes an electronic speed regulator which maintains the gyro at the speed selected by the STROBOTAC. The equipment behind the gyro measures the amount of weight to be removed from the gyro rotor to give balance, while the STROBOTAC again is used to point out the angular position at which unbalance should be removed.

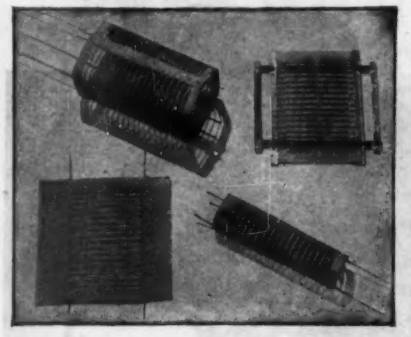
Gradually as the requirements of military security are relaxed, we hope that we can tell you of many other war uses for General Radio equipment.

In the meantime, possibly your interest in the STROBOTAC is associated with the war effort. STROBOTACS are available for top-priority war work. If you'd like detailed information about the STROBOTAC, ask for Bulletin 965

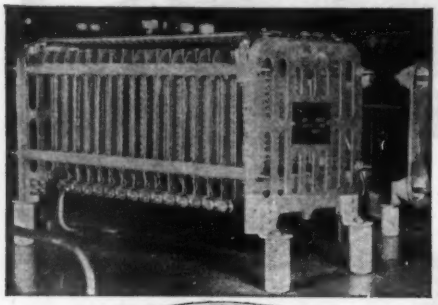
GENERAL RADIO COMPANY Cambridge 39, Massachusetts

90 West St., New York 6 920 S. Michigan Ave., Chicago 5 1000 N. Seward St., Los Angeles 38

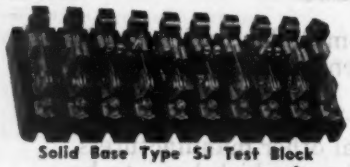
Ohm-spun
Resistors



These Resistors may be mounted in groups or singly, non-inductive, thin, flexible when desired. OhmSpun units are ideally suited for radio transmitters, loading equipment, and many other uses where reliable performance is a necessity. See Cat. 1 Sec. 5 for data for rating etc.



THE STATES COMPANY
HARTFORD CONN.



Solid Base Type SJ Test Block

Unit Base Blocks

Potential Current

Test Blocks simplify the installation and testing of watt-hour meters and relays. Among the many features built into the Type SJ Blocks may be listed.

1. No live parts extend beyond the base—an important safety feature
2. Mounted on both solid and unit bases—wider pole selection is available
3. Angle bent studs permit quickly changing front connected blocks over to back connected.

See Cat. 1 Sec. 9 for complete data.

-------- Tear off and mail today to --------

THE STATES COMPANY, Hartford 6, Conn.
Please send description of Resistors and Test Blocks.

Name ..... Title .....
Firm .....
City ..... Zone ..... State .....

become manager of the Williams Oil-O-Matic division of Eureka and a vice-president and director of the parent company.

•

Reconversion Inventory Kits Issued by A-C

To facilitate quick, easy reconversion inventories of industry's most widely used general purpose equipment, the Allis-Chalmers Manufacturing Co. announces that it will soon begin to distribute a newly prepared reconversion inventory kit, covering centrifugal pumps, V-belt drives, and electric motors.

An extension of Allis-Chalmers' wartime aid-to-maintenance program, the kit will enable the user to determine the exact condition of each piece of existing equipment which is scheduled for peacetime production duty.

This kit, which will be distributed free, contains a set of three fact sheets, one for each type of unit, with suggestions for inventory procedure. These kits are available by request from the nearest Allis-Chalmers district office or from Dept. 561, Allis-Chalmers Manufacturing Co., Milwaukee.

• •

Electrical Standards to Go Pre-War in Richmond, Va.

Because the Federal government is releasing materials for the manufacture of lighting fixtures and electrical appliances, Richmond, Va., has notified dealers in electrical supplies that beginning August 1 the Department of Public Utilities will resume strict enforcement of the city electrical ordinance.

The ordinance requires that all electrical devices and all appliances designed for attachment to or installation on any current or system in Richmond be listed as approved before being sold or used in the city.

Director J. R. A. Hobson said that the regulations had been relaxed because of war-time conditions and described some of the electrical equipment being sold as "junk."

•

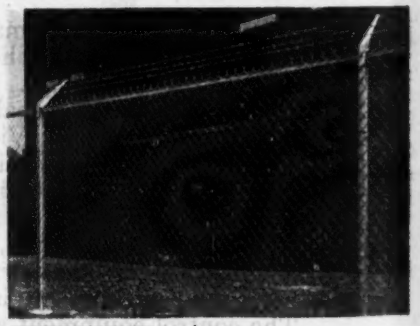
Moves Chicago Offices

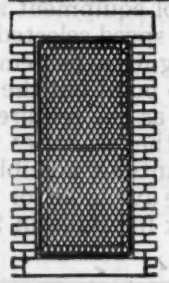
. Bentley, Harris Manufacturing Co., Conshohocken, Pa., manufacturer of electrical insulation, has announced the removal of its Chicago office, formerly at 440 West Huron St., to 43 East Ohio St. At the same time the company announced that Frank W. Garner is now in charge of the Boston office.

Stewart IRON and WIRE FENCES

YOUR BEST ASSURANCE AGAINST MALICIOUS TRESPASS

You can buy a Stewart Non-Climbable Chain Link Wire Fence right now if you need protection and your plant is essential to the war effort. The same is true of Stewart Window Guards; Sliding and Folding Steel Gates; Wire Mesh Partitions and other products. Write for free catalogue on Stewart Industrial Fence. The Stewart Iron Works Co., Inc., 1201 Stewart Block, Cincinnati 1, Ohio.





Stewart Style 3TH Chain Link Wire Fence

Stewart Wire Window Guards are available now for certain protective purposes. Made to fit any size or shape opening. When writing for prices, send sketch of opening and give all measurements involved.

Experts in Metal Fabrications Since 1886

Stewart IRON and WIRE FENCES

Copies You're Proud Of

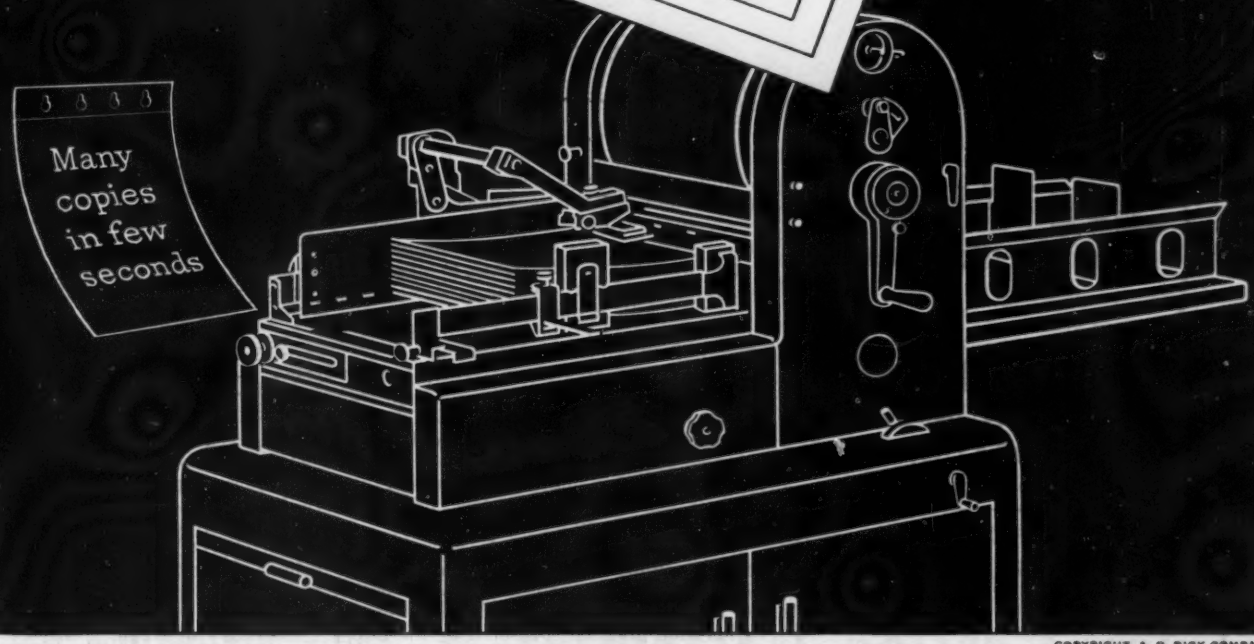
Mimeograph duplicator

For your business systems and all duplicating needs*

Mimeograph . . . speed

Mimeograph . . . ease

Mimeograph . . . results

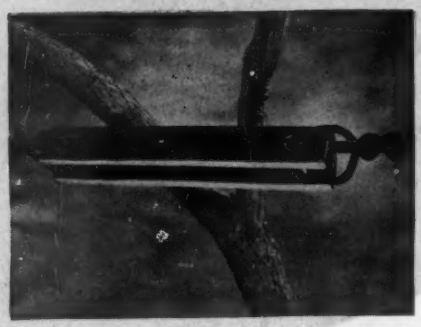


COPYRIGHT, A. B. DICK COMPANY

* For help in setting up systems that control and speed your paper work, address A. B. Dick Company, Chicago.

MIMEOGRAPH is the trade-mark of A. B. Dick Company, Chicago, registered in the U. S. Patent Office. A. B. DICK COMPANY, Chicago. The Mimeograph Company, Ltd., Toronto.

TREES



A problem in public relations . . . or just an insulating problem

PINCO tree insulators provide the answer

Costing less than a single tree trimming, a Pinco Tree Insulator pays for itself in a short time, not only in dollars and cents savings but also in the grief it saves the public relations department.

ALL PORCELAIN . . . Made entirely of Pinco High Test Porcelain it offers the insulating protection only porcelain can give and is unaffected by moisture or the abrasive action of rubbing branches.

EASILY INSTALLED . . . The Pinco Tree Insulator is easy to install. It needs only to be placed *on* the wire at the point of contact and secured at each end with tie-wires. Available in 12, 14 and 16 inch lengths. Where needed several units may be tied together. Write for complete information and prices.

Pinco Insulators are catalogued in the Electrical Buyers Reference

★ PINCO INSULATORS ★

THE PORCELAIN INSULATOR CORPORATION

LIMA, NEW YORK

PORCELAIN INSULATOR CORPORATION,
670 MAIN ST., LIMA, N. Y.

Gentlemen:
Please send me complete information on Pinco Tree Insulators:

NAME .....

TITLE .....

COMPANY .....

ADDRESS .....

.....

Field Reports on Business

Extensive electrical replacement work in ship repair yards is reported under way. The lifting of some restrictions on certain materials and equipment has begun to stimulate sales activtiy. Manpower, materials and transportation still critical factors. Lighting supplies continue in high demand.

PACIFIC COAST

Manpower is still a critical factor of Pacific Coast ship repair yards, as quality instead of quantity is needed for extensive electrical replacement and refitting of battle-damaged ships. Coast stocks of Navy 9-S and maritime electrical fittings though large are showing a good turnover. General construction has been steadily increasing in volume since August, and May 1945 showed the largest volume of building permits for the seven western states since latter 1942.

Railroad electrical purchasing continues at a high level, especially in signalling and carrier current equipment, because all lines to the coast are preparing to handle peak traffic of troops routed through embarkation points for Pacific War.

Industrial developments cover early construction of $700,000 plywood plant at Myrtle Creek, Ore.; and International Minerals & Chemical Co.'s $1,000,000 plant near San Jose for producing glutamate from beet sugar residue.

Small war plants in district comprising northern California, Nevada, and Idaho have been awarded more than 3,000 government contracts totaling $161,000,000 in the past three years.

WPB has approved $6,500,000 expansion of Los Angeles power station at Wilmington, a major item being its Westinghouse 65,000 steam turbine generating unit. Bonneville System is buying equivalent of seven cars of ½ and ¾-in. steel guy strand for distribution among several Oregon and Washington stations.

Alaska railroad has awarded contract for group of buildings at Anchorage, including depot, hotel, power plant and distribution system.

NEW ENGLAND

Relaxation of certain materials and equipment needed by both private and public institutions has begun to stimulate sales activity. Wentworth Institute, Boston, is installing Lite Control Corp. 74 fluorescent lighting units of 240 to 320-watt ratings, of which 60 will be used in the drafting room. Wentworth is receiving bids for an atomic hydrogen welder of 15 to 75 amp. range and a 15-kva. electric spot welder.

Massachusetts is planning on a maximum construction budget for modernization of institutions on recommendation of Governor Tobin. Quonset Point Naval station, Rhode Island, has awarded a contract for $32,247 to Coken & Co., Providence, R. I., for additions and improvements in the distribution system. Work on runways in New England airfields under the direction of Army Engineers is very active, involving lighting and communication facilities.

Domestic electric service development received an impetus last week in a two-day Boston meeting of northeastern home service specialists of utilities, the first of a nation-wide program sponsored by the Edison Electric Institute. Inquiries for appliances are voluminous, but as yet supplies are tight. Monsanto Chemical plans to start work at once on a $450,000 unit for thermal insulant production at its Merrimac Division plant near Boston.

General Electric, Bridgeport, has submitted a bid on 5,863 electric coffee makers for the Navy. Acme Electric Heating Co., Boston, has bid on heaters; American Optical Co. on electric lanterns and the National Co., Inc., Malden, Mass., on small transformers. New England Tape Co., Hudson, Mass., has submitted a naval bid on insulating materials. New store lighting is active in Boston retail areas.

CHICAGO

Because of its widely diversified list of war material plants the State of Illinois as a whole will remain in war production until V-J Day. However, cutbacks and concurrent unemployment will be uneven throughout the State. Certain one-industry areas that do not have other outlets for their workers face a severe problem. Chicago, however, with its greater diversification will be less affected, in the opinion of observers here.

Heartening to the civilian public have been the releases of materials for civilian production, though few will be on the market for several months. Last week saw third-quarter authorizations for electric iron production awarded to seven Chicago firms, as follows: L. Behrstock Co., 3,700; Birtman Electric Co., 24,793; Chicago Flexible Shaft Co., 43,341; Gibson Electric Mfg. Co., 1,250; National Stamping & Electric Works, 290; Lawrence M. Stein Co., 1,000 and Waage Mfg. Co., 1,600.

Guardite Corp. was awarded a Navy contract recently for $278,875 worth of test equipment for auxiliary power plant and aircraft heaters.

Wisconsin Public Service Corp. is arranging early calls for bids for a proposed new 35-mile, 110-kv. transmission line for which a priority rating has been assigned.

NEW YORK

Additional cutbacks in war orders is accompanied by a continuing trend toward relaxation of restrictions on production for civilian use. However, a shortage of manpower and materials is a deterring factor.

Civil engineering construction volume in continental United States totaled $46,540,000 last week, *Engineering News-Record* reports. This volume was 11 percent higher than in the preceding week, and 35 percent above the total for the corresponding 1944 week. Public construction for the week was up 33 percent compared with the preceding week, and was 10 percent over the 1944 week's volume. Private construction was 18 percent below a week ago, but exceeded a year ago by 167 percent. The week's construction brought the 1945 total to $876,155,000 for the 26-week period, a volume within 2 percent of the $891,830,000 reported for the corresponding period last year.

Shortages of staple goods, coupled with layoffs in some sections of the country are reported to be affecting retail activity, but in the Metropolitan area volume continued well above that of last year.

DESIGNS, TOOLING AND PRODUCTION ECONOMIES

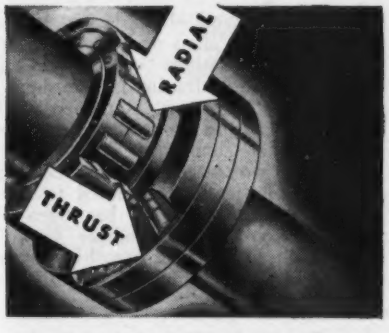
Ready-made for

THRUST APPLICATIONS

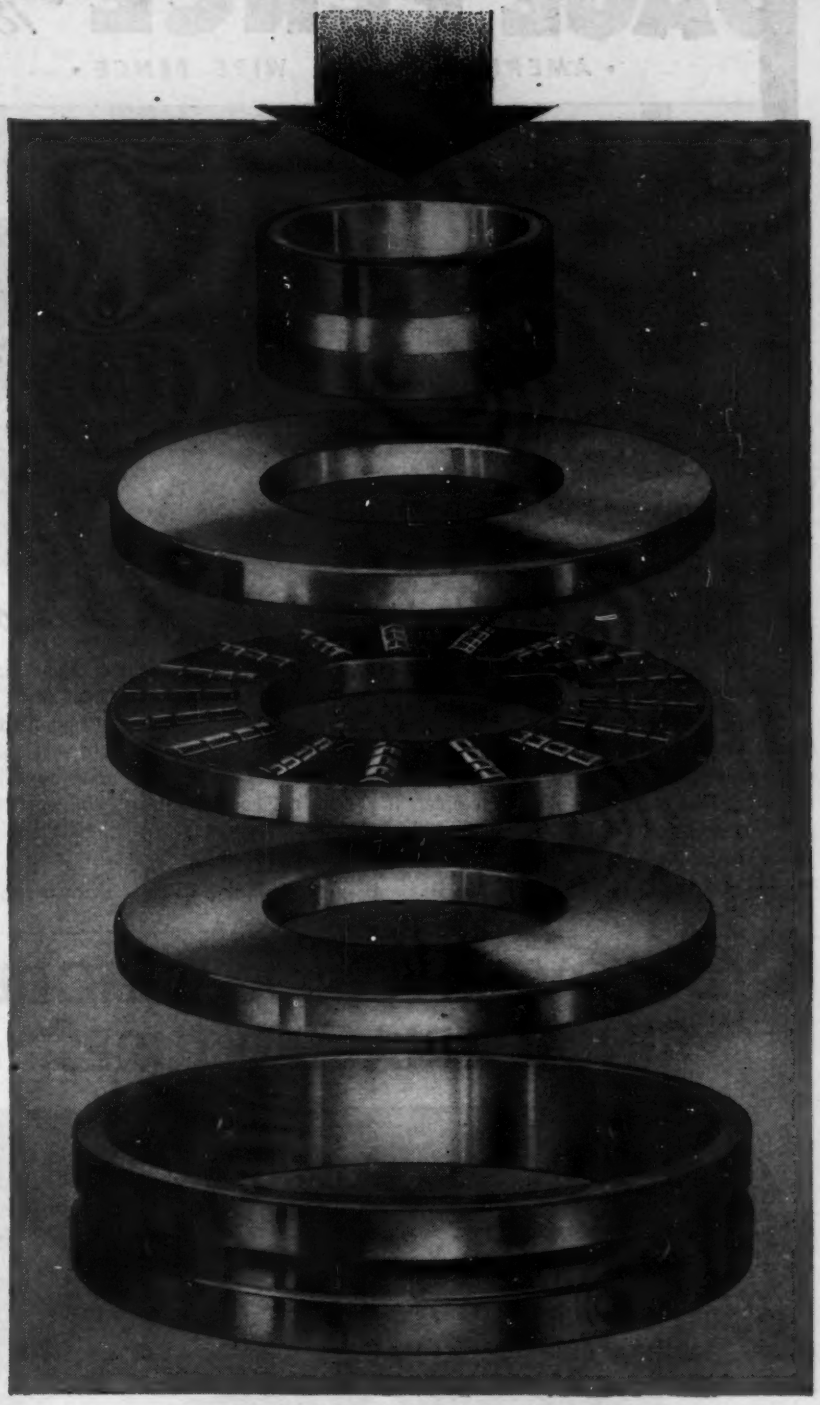
Rollway roller thrust bearings offer the widest selection in types and sizes. All the preliminary designs, tooling and production methods have been set up—assuring low cost and quick delivery for most applications.

Thrust loads are carried at right angles to the axes of solid cylindrical rollers. Rollers that are shortened to provide true rolling, and staggered to equalize distribution of wear. There are no diagonal resultants, no piling up of radial and thrust loads on the same bearing assembly. That's why you can carry heavier continuous, intermittent or reversing loads over longer periods of life expectancy—even under severe shock or vibration. Where compound loads are encountered, separate radial bearings carry the radial component, also at right angles to the roller axes.

ROLLWAY BEARING COMPANY, INC.
Syracuse, N. Y.



For compound loads SEPARATE radial and thrust bearings are used in combination as per diagram.



Simplified Double Acting — Type SDT

Select Bearings for the Job They Do

Size of shaft, limiting features of the application, loads, speeds and the duties required of the machine, all have an influence on the type and size of bearing you should use. Our engineering specialists will gladly make necessary calculations, drawings and supply the information required for a complete understanding of the problem. No charge or obligation.

ROLLWAY CYLINDRICAL ROLLER BEARINGS

SALES OFFICES: Philadelphia • Boston • Pittsburgh • Youngstown • Cleveland • Detroit • Chicago • St. Paul • Houston • Tulsa • Los Angeles

PAGE FENCE - Since 1883

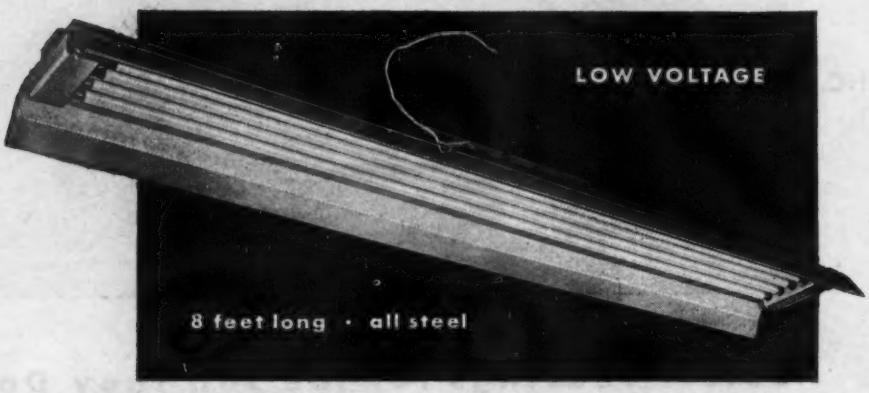
• AMERICA'S FIRST WIRE FENCE •

You Can Order Your Fence Now

• Because of the importance of property protection, war restrictions on chain link fence are among the first to be lifted. Many will want the fence that was denied them, as they have wanted other things long scarce or unobtainable except on highest priorities. It will take months to catch up with demand. Therefore, it is advisable to place your order NOW for long-lasting Page Fence. The Page Fence Association member nearest you will submit cost estimates and book your order. If you do not know his name, write or wire to the Association office in Atlanta, Bridgeport, Chicago, Denver, Los Angeles, Philadelphia, Pittsburgh, New York, San Francisco, or Monessen, Pennsylvania.

PRODUCT OF PAGE STEEL & WIRE DIVISION OF AMERICAN CHAIN & CABLE • BRIDGEPORT, CONN.

*COLOVOLT COLD CATHODE INDUSTRIAL FIXTURES



Here is the new Colovolt industrial fixture, one of a complete line of industrial and commercial "packaged" units. Equipped with the standard 93" Colovolt 10,000 hour lamp, Colovolt fixtures may be used singly or in continuous line lighting in multiples of 8 feet. Instantaneous starting, no flickering, guaranteed for 1 year except for failure due to breakage are extra advantages of the Colovolt Cold Cathode low voltage fluorescent lamp. The long life expectancy of Colovolt lamps may be realized even when constantly turned on and off, and *pre-scheduled re-lamping, with no loss of production or time, is now possible with Colovolt installations.*

*Trade mark registered U. S. Pat. Off.

Contact your electrical wholesaler or jobber, or write us for full details and prices.

GENERAL LUMINESCENT CORPORATION
660 S. FEDERAL STREET CHICAGO 5, ILLINOIS

Sales Opportunities

IOWA—Municipal Light and Water Works Department, New Hampton, has authorized surveys and estimates of cost for expansion in steam division of municipal power plant, including installation of new boiler, coal-handling equipment and accessory apparatus. Jesse B. Harris Co., Wesley Temple Bldg., Minneapolis, Minn., is consulting engineer.

VIRGINIA—American Viscose Corp., Delaware Trust Bldg., Wilmington, Del., will carry out expansion in branch mill for production of high-tenacity rayon yarns for tire cord manufacture for government, comprising additional buildings with machinery and electrical equipment for considerable increased capacity. Cost about $1,500,000, with financing by Defense Plant Corporation. Work will be placed under way at once.

MINNESOTA—Water and Light Department, Willmar, plans expansion in steam department of municipal power plant, including addition to building and installation of new boiler and accessories, coal-handling machinery and auxiliary apparatus. Pfeifer & Schultz, Wesley Temple Building, Minneapolis, are consulting engineers for the project.

ALABAMA—Tennessee Coal, Iron & Railroad Co., Birmingham, plans expansion and modernization in tin plate mill, including extensions in buildings and installation of additional machinery and electrical equipment for cold process production. Feeders, cleaners, etc., will be installed for tin stack service. Capacity of mill will be increased by about 1,000 tons per week. Cost estimated approximately $1,000,000. Work will get under way at early date.

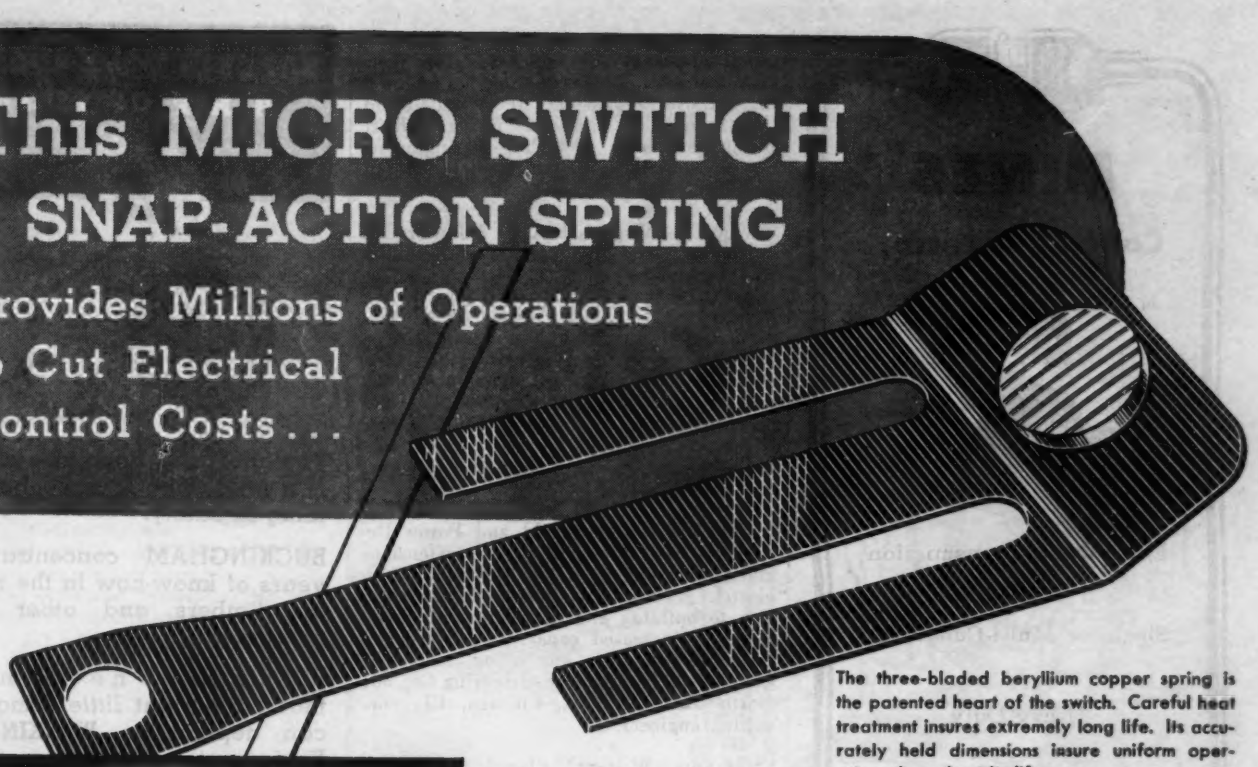
MARYLAND—Municipal Electric Department, Centerville, plans extensions in transmission and distribution lines for rural electric service, including power substation and other operating facilities. Application has been made for permission to proceed.

WASHINGTON—Department of Lighting, Seattle, has plans under way for four new power substations in different parts of city, with distribution transformers, switchgear and accessory equipment. Also will replace a present wooden pipe line used for water supply at Cedar Falls hydroelectric power plant with steel pipe line. Entire project is estimated to cost about $680,000. Application has been made to City Council to authorize fund in that amount for project, on which work is expected to begin immediately following such approval.

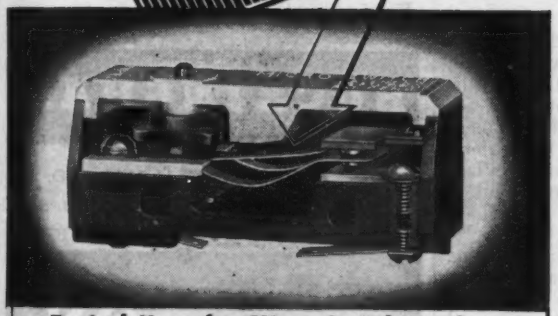
DELAWARE—General Motors Corp., General Motors Bldg., Detroit, Mich., will award contract soon for new assembling plant, to comprise main one and two-story, 700 by 1,200 ft., with machinery and electrical equipment for large output of assembled Buick, Oldsmobile and Pontiac automobiles. Also power house with 200-ft. stack, three large boilers and auxiliary equipment; power substation and several transformer stations in different parts of works; pumping plant and other utility structures. Several miscellaneous buildings will be erected for inspection, testing and

This MICRO SWITCH SNAP-ACTION SPRING

Provides Millions of Operations to Cut Electrical Control Costs . . .



The three-bladed beryllium copper spring is the patented heart of the switch. Careful heat treatment insures extremely long life. Its accurately held dimensions insure uniform operations throughout its life.



Micro Switch snap-action switches are used in almost every branch of industry because they possess performance ability and operating characteristics never before found in this type of switch.

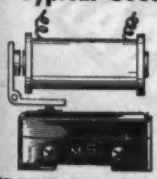
The reliable and positive operation of Micro Switch products is made possible by this one-piece beryllium copper spring which has the high fatigue resistance necessary to assure 5,000,000 or more trouble-free mechanical operations.

This Micro Switch spring, which is specially heat treated, provides a snap motion in the same direction as the operating plunger. It has no reverse bends, no life-limiting "oil-can" action.

By the use of this principle, Micro Switch has produced a tiny switch (11/16" x 27/32" x 1 15/16") which weighs less than an ounce and yet is able to control substantial amounts of power at line voltages up to 460V AC without the use of relays.

Micro Switch supplies these thumb-size, plastic enclosed switches equipped with a complete line of accessories, actuators and housings that adapt them for the widest variety of installations.

Typical Uses for Micro Switch Products

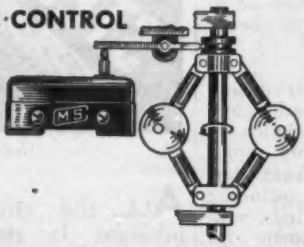


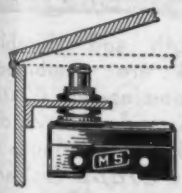
ELECTRO MAGNET RELAY

Pin plunger switch actuated by an electro magnet relay.

SPEED GOVERNOR CONTROL

Spring plunger switch actuated by deviation of governor from predetermined speed.





CABINET DOOR SWITCH

Panel mount switch actuated by opening or closing door of high tension cabinet.

If you need a precise, snap-action switch for electrical control, one which is extremely resistant to temperature and atmospheric changes, send for the Micro Switch Handbook-Catalog today. In it you will find complete details of electrical characteristics, construction features, housings and actuators.

LET'S ALL BACK THE ATTACK *BUY EXTRA WAR BONDS*

© 1945 First Industrial Corporation

MICRO MS SWITCH

TRADE MARK

A DIVISION OF FIRST INDUSTRIAL CORPORATION

Freeport, Illinois, U.S.A. Sales Offices in Principal Cities

The basic switch is a thumb-size, feather-light, plastic enclosed, precision, snap-action switch, Underwriters' listed and rated at 1200 V. A., at 125 to 460 volts a. c. Capacity on d.c. depends on load characteristics. Accurate reproducibility of performance is maintained over millions of operations. Basic switches of different characteristics are combined with various actuators and metal housings to meet a wide range of requirements.

MINES

Cable Connectors

For Power Transmission

Single or Multi-Conductor

Heavy Duty

Water Sealed

Molded Rubber or Synthetic

Can Be Molded at Factory to Specifications on Your Cords or Cables

Stand Rough Handling and Difficult Conditions

Capacities from 5 to 500 Amperes

Voltages Up to 5000

Carried in Stock in Standard Designs and Sizes and Can Be Made Up Special to Meet Your Specific Requirements.

Write for Bulletin MC-106, showing many successful applications of Mines Connectors throughout industry.

MINES EQUIPMENT COMPANY

4235 Clayton Avenue

St. Louis 10, Missouri

other service. Plant will have gross floor area of about 1,500,000 sq. ft. and is reported to cost over $7,500,000. It is understood that project has a priority rating. Albert Kahn Associated Architects & Engineers, New Center Bldg., Detroit, is architect and engineer.

VIRGINIA—Virginia Electric & Power Co., Richmond, has plans and surveys under way for primary and secondary lines for large expansion in rural electric system in different counties in Virginia, West Virginia and North Carolina. Program will be carried out over a period of months and is estimated to total approximately 3,000 miles in all, with service connections and other operating facilities. Cost reported over $3,000,000. Main part of project will mature as soon as materials and equipment are available.

INDIANA—Electric Light and Power Department, Crawfordsville, plans extensions and improvements in municipal steam-electric generating station, including addition to building and installation of equipment for increased capacity. Surveys and estimates of cost are being made by Commercial Testing & Engineering Co., 307 North Michigan Ave., Chicago, Ill., consulting engineer.

ILLINOIS—Western Electric Co., 195 Broadway, New York, N. Y., has contracted with government for expansion in Hawthorne Works, for production of aircraft instruments, with installation of additional machinery and electrical equipment for large increased capacity. Cost about $1,250,000, with financing by Defense Plant Corporation. Work will be carried out at early date.

CONNECTICUT—United Illuminating Co., Bridgeport, has plans under way for new power substation, reported to cost over $50,000, with transformers, switchgear and auxiliary equipment.

INDIANA—Crosley Corp., 1329 Arlington Ave., Cincinnati, Ohio, radios, refrigerators, gas ranges, etc., plans expansion in branch plant, comprising several new buildings, with machinery and electrical equipment for large increased output. Cost estimated about $2,000,000. Project is understood to have a priority rating and work will begin soon.

WASHINGTON—Bureau of Yards and Docks, Navy Department, Washington, D. C., has arranged an appropriation of $10,965,000 for expansion in ship repair facilities at Puget Sound Navy Yard, during fiscal year beginning July 1, including additional shops and other buildings, with machinery and electrical equipment for large capacity. Program will include installation of electric traveling cranes and other mechanical-handling facilities; extensions in electrical distribution lines, power substations and other electrical structures. Proposed to begin work on the project at an early date.

WASHINGTON—Department of Public Utilities, Tacoma, has received permission from WPB to proceed with construction of second unit at Alder hydroelectric generating station of Nisqually project, under way for number of months past. Work will include installation of a 25,000-kw. hydraulic turbine unit and auxiliary equipment, as well as miscellaneous work for completion of station, which will have a rating of 50,000 kw. Initial generating unit is expected to be ready for service next fall.

SAFETY DEPENDS ON A BIT OF METAL

The spur in a lineman's climbers is a *little* thing in size—but a *big* thing in safety.

BUCKINGHAM concentrates 40 years of know-how in the making of climbers and other safety equipment.

BUCKINGHAM never neglects those important *little* things. You can depend on BUCKINGHAM Equipment.

BUILT BY BUCKINGHAM OF BINGHAMTON

W. H. BUCKINGHAM MFG. CO.
BINGHAMTON 9, N. Y. U. S. A.

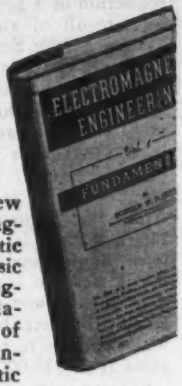
ALL the strength and durability inherent in steel are combined—with definite economies—in *Crapo* Galvanized Steel Strand. Heavy, ductile, tightly-bonded zinc coatings, applied by the famous *Crapo* Galvanizing Process, provide lasting protection against corrosion.

Ask the distributor of *Crapo* Galvanized Products near you or write direct for further information!

INDIANA STEEL & WIRE CO.
MUNCIE, INDIANA

Engineering applications of electrodynamic theory

A systematic, step-by-step introduction to the fundamental concepts of electromagnetism as applied to such engineering problems as antennas, wave guides, micro-wave circuits



THIS book offers a new approach to electromagnetism, giving a systematic introduction to those basic concepts of electromagnetism which are fundamental to the study of electromagnetic waves, antennas, electromagnetic horns, wave guides, and ultra-high frequency and microwave circuits.

Beginning with first principles, the physical and mathematical essentials of electrodynamics are logically developed and critically discussed for the purpose of applying them to engineering problems.

Just Published!

ELECTROMAGNETIC ENGINEERING

Volume I — Fundamentals

By RONOLD W. P. KING

Associate Professor of Physics and Communication Engineering, Harvard University

580 pages, 5¼ x 8¼, 75 illustrations, $6.00

THIS simplified approach to electrodynamics gives the engineer the tools he needs to understand and keep abreast of engineering applications of time-proved physical theories. Using a logical, step-by-step method, it systematically defines electromagnetic concepts in such a way as to show the interrelation between all branches of electricity, emphasizing the fundamental analogies in electric and magnetic quantities.

- **gives systematic study of skin-effect in conductors and condensers**
- **analyses the impedance of a condenser at ultra-high frequencies**
- **gives an entirely new general derivation of the transmission-line equations for two and four-wire lines**
- **includes a complete set of relatively simple problems to help in learning the principles of electromagnetism**

CONTENTS

Introduction: the Physical World and its Analogue
1. Mathematical Description of Matter
2. Mathematical Description of Space and of Simple Media
3. Transformations of Field and Force Equations
4. Electromagnetic Waves in Unbounded Regions
5. Skin Effect and Internal Impedance
6. Electric Circuits
Historical and Critical Retrospect
Appendices

SEE it 10 days • SEND this coupon

McGRAW-HILL EXAMINATION COUPON

McGraw-Hill Book Co., 330 W. 42nd St., New York 18

Send me King's Electromagnetic Engineering, Vol. 1, for 10 days' examination on approval. In 10 days I will send $6.00, plus few cents postage, or return book postpaid. (Postage paid on cash orders.)

Name .....

Address .....

City and State .....

Company .....

Position .....W 7-7

(Books sent on approval in U. S. only.)

17 REASONS WHY IT'S DIFFERENT

AND EVERY REASON IS INDICATED BY OUR PATENT CLAIMS ON THIS DESIGN

PENETRAY

Reduced glare is an important reason for your selection of a Specific Near Infra-red source. Next, for baking, drying and evaporating, a radiant source peaking between 13,000 and 14,000 Angstrom Units is most desirable. These are two definite reasons for your use of Penetray.

Penetray production is unusually costly because of filament and construction detail. This, in our opinion, is necessary to a quality product. Lamp life and efficiency is imroved - resistance to vibration being maximum. A nonex arbor protects against softening of glass and resulting distortion of filament due to sagging. Radiant energy is emitted in both the vertical and horizontal. Honestly, now, don't you want to know more about this new product and the prospect of improved results?

INFORMATION ON REQUEST - WITHOUT OBLIGATION

LEARN TO SAY PENETRAY

VERD-A-RAY CORPORATION • TOLEDO 3, OHIO

Royal-ettes

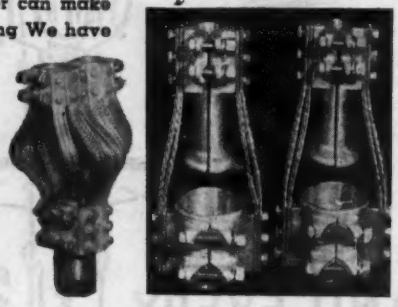
#15 in a series of informative letters from a producer of Power Switching Equipment.

A FULL LINE OF BUS FITTINGS

Ranging from Tee Connectors to Stud Connectors and Bus Supports, the complete line of Royal Expansion Bus Fittings covers practically all the service requirements of utilities and industrials. To enable you to select the items you need easily and correctly, detailed application data is given on pages 24 to 28 of our catalog.*

Of course, any manufacturer can make a good, serviceable bus fitting We have a healthy respect for good competitive equipment. It keeps us on our toes—alert and working. Royal's bid for recognition is: Exclusive, patented features produce improved service to users.

*Got a copy? We'll gladly send you one.



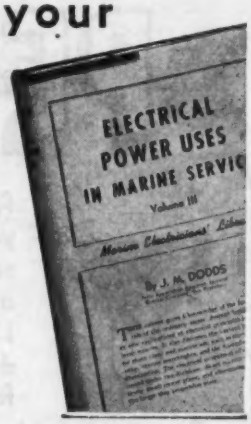
TWO TYPES OF ROYAL BXS EXPANSION STUD CONECTORS

ROYAL ELECTRIC MFG. CO. 619 E. 40th Street CHICAGO 15, ILL.

Use this manual for all your SHIPBOARD ELECTRICAL WORK

A practical guide to the parts, use, regulation and control of each part of the electrical apparatus of the ship and shipyard except radio.

The book provides direct guidance for the most efficient operation and maintenance of all electrical equipment, except radio, completely in line with modern practice. Put it to use to insure greatest efficiency from your electrical power installations, and as a dependable guide for your operators in control and maintenance.



Just Published!

ELECTRICAL POWER USES IN MARINE SERVICE

Vol. III Marine Electricians' Library

By J. M. DODDS

Field Engineer, Pacific District Engineering Division, General Electric Company; Instructor, Engineering, Science, Management War Training, University of California

434 pages, 5¼ x 8¼, 185 illus., $4.00

Contains description of:

A-C and D-C motors
crane and hoist motors
gears
complex control circuits
ordinary incandescent lamps
vapor discharge, glow and fluorescent lamps

Over 25 tables provide useful information concerning motor speeds, effect of variation of voltage on various motors, candle powers, etc.

Clear, simple, complete explanations of:

—fundamentals of the ordinary incandescent lamp
—direct current electric ship propulsion and control
—control of the deck winch, capstan, anchor hoist
—maintenance of electrical equipment—control, windings, brushes, commutators, bearings
—deduction and correction of electrical trouble aboard ship

SEE IT 10 DAYS ON TRIAL

McGRAW-HILL BOOK COMPANY, Inc.
330 West 42nd St., New York 18, N. Y.

Send me Dodds' Electrical Power Uses in Marine Service for 10 days examination on approval. In 10 days I will send $4.00 plus few cents postage, or return book postpaid. (Postage paid on cash orders.)

Name .....
Address .....
City and State .....
Position .....
Company .....W 7-7-45
(Books sent on approval in United States only.)

Recent Rate Changes

OKLAHOMA GAS & ELECTRIC CO. customers in 22 northwest Arkansas cities and towns will receive an annual overall reduction of 5 percent in their electric bills as a result of an order issued by the Arkansas Public Service Commission. Charles C. Wine, chairman of the commission, said that the reductions resulting from the revised rate schedule approved by the commission, would amount to $32,000 annually to the Arkansas consumers served by the company. Only 7 percent of the property of the utility is located in the state of Arkansas. However, the rate reduction by the company is general and will amount to an annual saving of approximately $500,000 a year to Oklahoma customers. Residential customers in Arkansas will receive a cut in their bills of $14,000 annually, while savings to commercial consumers will amount to $18,000.

ROCHESTER GAS & ELECTRIC CORP. has reduced its electric rates $753,000, effective June 25. Under the new tariffs residential consumers will save approximately $305,000 annually on their electric bills and commercial and industrial users will benefit to the extent of about $383,000 per annum. In addition, street lighting rates in Rochester and in outside communities will be reduced $65,000 a year. The company's tariffs provide two levels of rates, one applicable in the City of Rochester and adjacent area and the other effective in the remainder of the territory. Under the new filings the savings for residential consumers will range from 15 cents a month for the smallest users to $2.93 per month in the Rochester area for customers who use 1,200 kw. or more per month and up to $3.23 per month in the rest of the territory. The reductions were requested by the New York Public Service Commission after an examination of the company's revenues showed a large increase in its earnings, the commission announced. A proposal by the company several weeks ago to reduce rates by $500,000 was rejected by the commission as insufficient. The reduction of more than three quarters of a million dollars was finally agreed upon.

STATEN ISLAND EDISON CORP. has set up a new schedule of rates for electric service, providing for an annual reduction of approximately $292,000. The new tariff, effective July 1, sets forth an annual residential rate, a rate for summer residential service between June 1 and September 30 and commercial and industrial rates. There is also a change in the coal adjustment clause which produces a reduction of $114,000 and is included in the total reduction.

GEORGIA POWER CO. has announced reductions in electric rates, amounting to $179,700 annually for municipal street lighting and water pumping purposes. The new rates provide savings of $128,700 for 287 communities which purchase power for street lighting and $51,000 for 182 towns which use Georgia Power Co. service for water pumping. The saving to Atlanta will amount to $39,000 annually on street lighting, or 18.6 percent of the present cost of this service. The new rates became effective July 1.

OHIO EDISON CO. has been granted a new five-year lighting contract by City Council, Struthers, Ohio, which will save $6,900 in 1945, and a new three-year rate ordinance for residential and commercial users which will save $3,500 a year. Utility officials said that the new street lighting contract will in addition to the $6,900 sav-

ing in 1945, provide a saving of $350 a year for the remaining four years of the contract.

CAROLINA POWER & LIGHT CO.'s application for a new rate schedule applicable to municipalities in the resale of energy has been approved by the North Carolina Utilities Commission. The new schedule will result in annual savings of $77,000 to municipalities, and consequently, to the customers of municipalities.

SOUTHWESTERN PUBLIC SERVICE CO., Amarillo, Tex., has filed rate reductions for electricity and gas in Oklahoma panhandle cities and towns which will amount to $15,728 a year. The electric reductions for 17 towns will aggregate $2,286 a year. The new schedules will be effective October 1.

LEWISBURG, TENN., electric consumers will save approximately $22,500 a year as a result of the adoption of new rates by the Lewisburg light and power department, T.V.A. has announced. Lewisburg is the eighth system in the TVA. area to adopt these lower rates within the past year. The new rates became effective in Lewisburg with bills rendered on and after June 15. Residential consumers will experience an average reduction of 25 percent under the new rates. The total reduction for this class of consumer is $11,100. The bills of small commercial consumers will be reduced $4,400, or 20 percent on the average, while those of large commercial and industrial consumers will be reduced by $7,000, which on the average is 14 percent.

REA Allots Funds; Approves Contracts

Recent allotments announced by the Rural Electrification Administration total $11,178,400 to 90 cooperatives in 26 states. The allotments, most of which will provide for further extension of electric service, are made against the loan authorization for the fiscal year 1946.

Included are the following:

ALABAMA—Covington Electric Cooperative, Inc., Andalusia, $100,000.

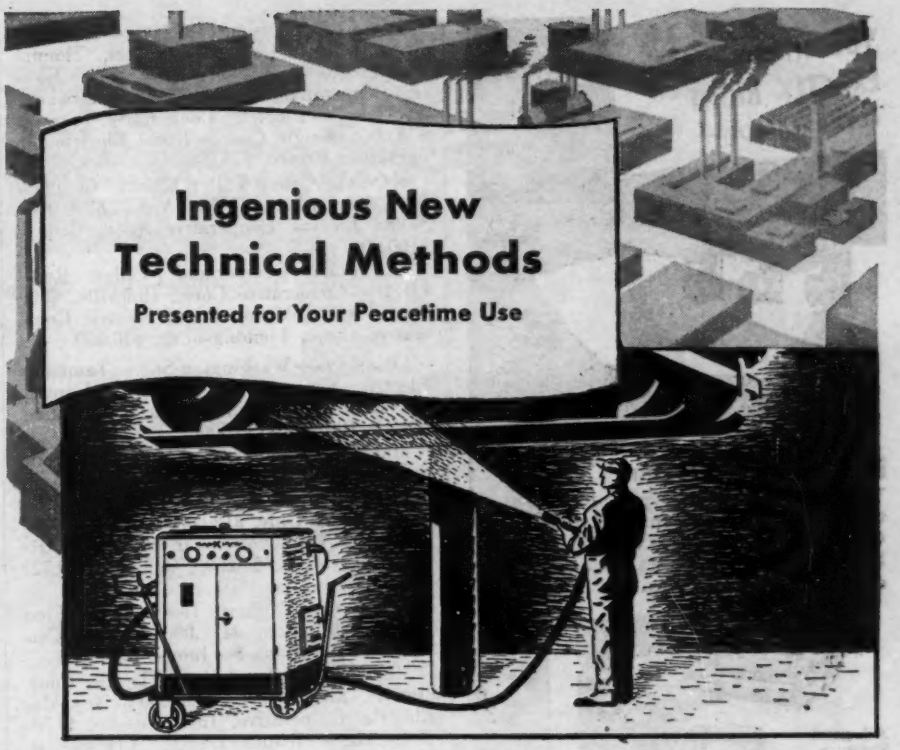
ARKANSAS—Woodruff Electric Cooperative Corp., Augusta, $200,000.

FLORIDA—Clay Electric Cooperative, Inc., Keystone Heights, $50,000; Suwanee Valley Electric Cooperative, Inc., Live Oak, $50,000.

GEORGIA—Okefenoke Rural Electric Membership Corp., Nahunta, $300,000; Middle Georgia Electric Membership Corp.; Vienna, $125,000; Little Ocmulgee Electric Membership Corp., Alamo, $50,000.

INDIANA—Dubois Rural Electric Cooperative, Inc., Jasper, $450,000; Clark County Rural Electric Membership Corp., Sellersburg, $215,000; Orange County Rural Electric Membership Corp., Orleans, $150,000; Fulton County Rural Electric Membership Corp., Rochester, $50,000; Whitley County Rural Electric Membership Corp., Columbia City, $50,000.

IOWA—Eastern Iowa Light & Power Cooperative, Davenport, $150,000; Rideta Electric Cooperative, Inc., Mount Ayr, $120,000; Buena Vista County Rural Electric Cooperative, Storm Lake, $100,000; Sioux Electric Cooperative Assn., Orange City, $100,000; South Crawford Rural Electric



Coming to Users of Gas-Powered Equipment

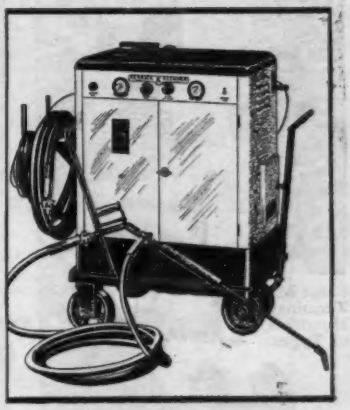
80% SAVINGS IN CLEANING TIME

with Steam Rig Now the Army's Standby

An economical solution to the problem of cleaning and degreasing trucks, passenger cars, tractors, locomotives, excavators, and the like will be available to garages, service stations, all users of oil-burning equipment, as soon as war demands permit. It is a more efficient steam cleaner now in use by the thousands in the Armed Forces.

Neat "housekeeping" has too often been neglected by industry due to the costliness of hand labor. But the best housekeepers in the World, the U. S. Army, Navy and Marine Corps, dare not neglect frequent and thorough cleaning of all equipment to safeguard against fire and malfunctioning, and to permit fast, certain inspection. This cleaner, developed to meet their high standards, removes grease, dirt and grit 5 times as fast as any other method. It cleans by a balanced combination of heat, detergent, water and friction. It is typically "army" in simplicity of design and operation; in 30 minutes, the entire machine can be dismantled and completely cleaned.

Wartime uses of Wrigley's Spearmint Gum also point the way that industry may benefit when this quality product again becomes available. It will *again* be a "help on the job" in many ways. Right now *no* Wrigley Spearmint Gum is being made, as present conditions do not permit the manufacture of Wrigley's Spearmint in quantity and quality sufficient for all. But remember the Wrigley's Spearmint wrapper--it is a certificate of highest quality and flavor—and will always remain just that.



The Kerrick Kleaner

Remember this wrapper

You can get complete information from
Clayton Manufacturing Company
Alhambra, California

Z-76

You always find the
EXACTLY RIGHT
Terminal Lug—

in the COMPLETE line

You'll see ALL good types of terminals in the Penn-Union Catalog. Shown above is the EZ; below are a few pictures giving an idea of the wide variety:

All good Pressure and Solder Terminals

Sheet Metal Terminals—Hundreds of Types

Also Tees, Taps, Straight Connectors, Grounding Clamps, etc. etc., thousands of items. And every one is Dependable, mechanically and electrically. Penn-Union fittings are the first choice of experienced users.

PENN-UNION
ELECTRIC CORPORATION
ERIE, PA.

PENN-UNION
Conductor Fittings

Cooperative, Denison, $100,000; Winnebago Rural Electric Cooperative Assn., Thompson, $100,000; Butler County Rural Electric Cooperative, Allison, $75,000; Hawkeye Tri-County Electric Cooperative, Cresco, $75,000; Wright County Rural Electric Cooperative, Cresco, $75,000.

KANSAS—Caney Valley Electric Cooperative Assn., Inc., Cedar Vale, $200,000; Sekan Electric Cooperative Assn., Girard, $100,000.

KENTUCKY—Cumberland Valley Rural Electric Cooperative Corp., Pineville, $50,000; Fleming-Mason Rural Electric Cooperative Corp., Flemingsburg, $50,000.

LOUISIANA—Washington-St. Tammany Electric Cooperative, Inc., Franklinton, $265,000; Beauregard Electric Cooperative, Inc., DeRidder, $150,000.

MARYLAND—Choptank Electric Cooperative, Inc., Denton, $289,000.

MICHIGAN—Thumb Electric Cooperative of Michigan, Ubly, $120,000 for generating facilities; Top O'Michigan Rural Electric Co., Boyne City, $50,000, including $9,722 for generating facilities.

MINNESOTA—Nobles Cooperative Electric, Worthington, $117,000; South Central Electric Assn., St. James, $86,000.

MISSOURI—Atchison-Holt Electric Cooperative, Rock Port, $180,000; New-Mac Electric Cooperative, Inc., Neosho, $170,000; Three Rivers Electric Cooperative, Linn, $160,000; Barton County Electric Cooperative, Lamar, $120,000; Platte-Clay Electric Cooperative, Inc., Platte City, $145,000.

MONTANA—Flathead Electric Cooperative, Inc., Kalispell, $160,000; Big Horn County Electric Cooperative, Inc., Lodge Grass, $93,000.

NEBRASKA—Custer Public Power District, Broken Bow, $480,000; Cuming County Rural Public Power District, West Point, $250,000; Burt County Rural Public Power District, Tekama, $125,000.

NEW MEXICO—Roosevelt County Electric Cooperative, Inc., Portales, $50,000.

NORTH CAROLINA—Roanoke Electric Membership Corp., Rich Square, $285,000; Woodstock Electric Membership Corp., Belhaven, $230,000; Davidson Electric Membership Corp., Lexington, $211,000; Wake Electric Membership Corp., Wake Forest, $186,000; Edgecombe-Martin Co. Electric Membership Corp., Tarboro, $176,000; Lumbee River Electric Membership Corp., Raeford, $154,000; PeeDee Electric Membership Corp., Wadesboro, $132,000; Cornelius Electric Membership Corp., Cornelius, $119,000; Rutherford Electric Membership Corp., Forest City, $118,000; Randolph Electric Membership Corp., Asheboro, $85,000.

OHIO—Carroll Electric Cooperative, Inc., Carrollton, $150,000; North Western Electric Cooperative, Inc., Montpelier, $60,000.

OKLAHOMA—Southeastern Electric Cooperative, Durant $160,000; Kay Electric Cooperative, Blackwell, $120,000.

OREGON—Juntura Electric Cooperative, Inc., Juntura, $148,000; Douglas Electric Cooperative, Inc., Roseburg, $63,000.

SOUTH CAROLINA—Salkehatchie Electric Cooperative, Inc., Barnwell, $260,000; Tri-County Electric Cooperative, Inc., St. Matthews, $165,000; Aiken Electric Cooperative, Inc., Aiken, $56,000.

SOUTH DAKOTA—Sioux Valley Empire Electric Assn., Inc., Colman, $100,000.

TENNESSEE—Mountain Electric Cooperative, Mountain City, $300,000.

TEXAS—Jasper-Newton Electric Cooperative, Inc., Kirbyville, $250,000; Navarro County Electric Cooperative, Inc., Corsicana, $125,000; Cherokee County Electric Cooperative Assn., Rusk, $110,000; Limestone County Electric Cooperative, Inc.,

For Electrical Installation, Maintenance, Repair— Light anywhere— at the flick of a finger— with

Big Beam
PORTABLE ELECTRIC HAND SEARCHLIGHTS

The men who install, maintain and repair electrical wiring and equipment must work under any and all conditions. Big Beam enables them to put light on the work wherever it may be called for. It projects a beam of more than 2500 feet and by the use of a snap-on lens gives the same volume of light over a wide area. Lights up anything at any height—any recess or corner, at the flick of a finger, and can be set down anywhere—on a bench, shelf or floor—or can be clamped to any flat surface by means of a hold-down. Big Beam is working in war plants and on war fronts, doing the same jobs it can do for you. Put it to work for you. It will be a valuable assistant.

Write today for catalog and full description of Big Beam Portable Electric Hand Searchlight. Storage Battery or dry cell models.

U-C LITE Mfg. Co.
Dept. D • 11 E. Hubbard St. • Chicago 11, Ill.

Mart, $110,000; Fort Belknap Electric Cooperative, Inc., Olney, $100,000; Kaufman County Electric Cooperative, Inc., Kaufman, $100,000; Swisher County Electric Cooperative, Inc., Tulia, $100,000; Greenbelt Electric Cooperative, Inc., Wellington, $92,000; Coleman County Electric Cooperative, Inc., Coleman, $75,000; Denton County Electric Cooperative, Inc., Denton, $50,000; Fayette Electric Cooperative, Inc., LaGrange, $50,000; Johnson County Electric Cooperative Assn., Cleburne, $50,000; Panola-Harrison Electric Cooperative, Inc., Marshall, $50,000; Rusk County Electric Cooperative, Inc., Henderson, $50,000; Brazos Valley Refrigeration Cooperative, Inc., Bellville, $18,000; Collin County Refrigeration Cooperative, Inc., Wylie, $15,000; Farmers Electric Refrigeration Cooperative, Inc., Emory, $8,400.

VIRGINIA—Community Electric Cooperative, Suffolk, $125,000; Free State Refrigeration Cooperative, Inc., Kenbridge, $52,000; Powhatan Refrigeration Cooperative, Inc., Powhatan, $45,000.

WYOMING—Shoshone River Power, Inc., Cody, $50,000.

Construction Contracts Approved

ARIZONA—Littlefield Electric Cooperative, Inc., Littlefield, contract to Atrend Electric Service Co., Salt Lake City, Utah, 14 miles of line, labor and materials, $17,422; engineer, W. W. Cannon, St. George, Utah.

ILLINOIS—Clay Electric Cooperative, Inc., Flora, contract to T & D Electrical Servicing, St. Elmo, Ill., 27.6 miles of line; labor only, $11,801; engineer, Michael Drazen & Associates, St. Louis, Mo.

MINNESOTA—Lake Region Cooperative Electrical Assn., Pelican Rapids, contract to O'Leary & Stotko, Hancock, Minn., 114 miles of line; labor only, $31,940; engineer, A. J. Christopherson, Fergus Falls, Minn. North Itasca Electric Cooperative, Inc., Bigfork, contract to W. A. Patterson & I. O. Teigen, St. Paul, Minn., stringing of conductor on 304 miles of line; labor only, $21,591; engineer, Banister Engineering Co., St. Paul, Minn.

MISSOURI—Pemiscot-Dunklin Electric Cooperative, Hayti, contract to Guy-Townsend Co., Jackson, Tenn., 50 miles of line; labor and materials, $53,552; engineer, Rural Line Engineers, Clayton, Mo.

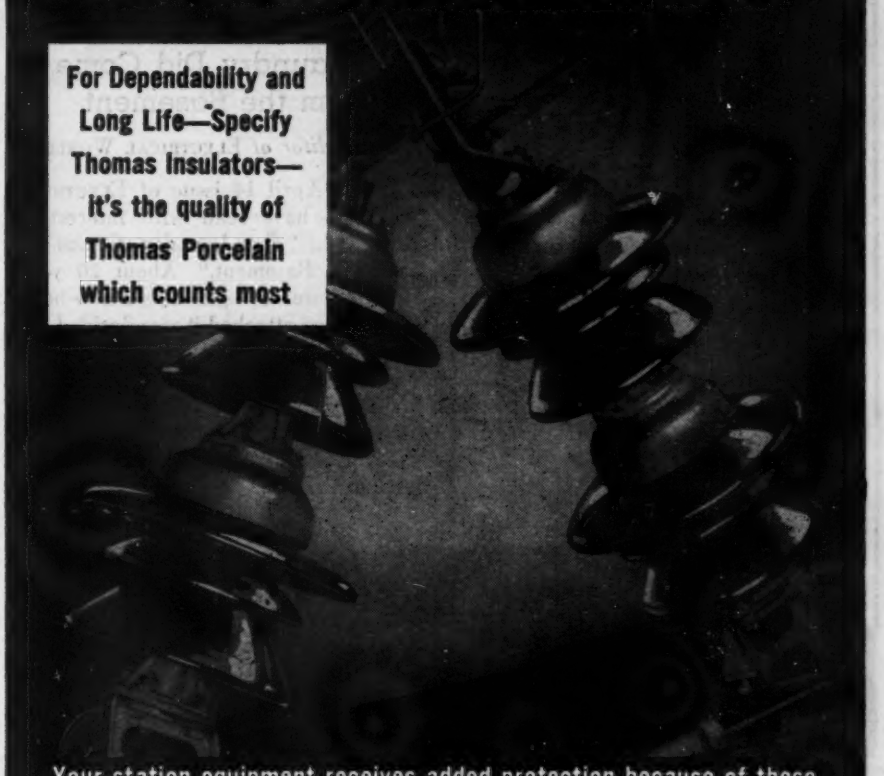
NEBRASKA—Norris Rural Public Power District, Lincoln, contract to ABC Electric Co., Lincoln, Neb., 8 miles of line; labor only, $3,848; engineer, H. H. Henningson Engineering Co., Omaha, Neb.

OKLAHOMA—Rural Electric Cooperative, Inc., Lindsay, contract to G. M. McLaughlin Co., Oklahoma City, Okla., 39.7 miles of line; labor and materials, $33,719; engineer, C. H. Guernsey & Co., Oklahoma City, Okla. Oklahoma Electric Cooperative, Norman, contract to G. M. McLaughlin Co., Oklahoma City, Okla., 18.3 miles of line; labor and materials, $19,082; engineer, C. H. Guernsey & Co., Oklahoma City, Okla. Red River Valley Rural Electric Assn., Marietta, contract to Hufford & Kyger Constr. Co., Kansas City, Mo., 39 miles of line; labor only, $15,058; engineer, Midwestern Engineers, Tulsa, Okla.

TEXAS—Brazos Valley Refrigeration Cooperative, Inc., Bellville, contracts to E. E. Rapeilver, Hempstead, Texas, Straus-Frank Co., Houston, Texas, and B & B Engineering Co., Houston, Texas, two locker plants; labor and Materials, $66,000; engineer, Harry R. Guiberson, Ft. Worth, Texas. Taylor Electric Cooperative, Inc., Merkel, contract to Teague & Goodman, Sherman, Texas, 80 miles of line; labor and materials, $60,756; engineer, H. N. Roberts, Lubbock, Texas.

THOMAS INSULATORS
FOR SWITCH AND BUS SUPPORTS

For Dependability and Long Life—Specify Thomas Insulators—it's the quality of Thomas Porcelain which counts most



Your station equipment receives added protection because of these outstanding features of Thomas Switch and Bus Insulators

- Each unit meets EEI and NEMA basic insulation standards, and also offers the plus value of Thomas patented "Quiet-Type" radio noise free protection where necessary—at no extra cost.
- A complete size range is offered for every practical voltage application. Each insulator is carefully made, tested and approved under the experienced supervision of skilled craftsmen and engineers.
- To accomplish absolute uniformity and precision, utmost care is taken in assembling these insulators in heavy, fully machined jigs. Consequently, apparatus can be designed and assembled ready for the insulators without fear of major adjustments to clearances and alignment being necessary. Perfect alignment is maintained and precise interchangeability of units guaranteed.
- Balanced Electrical, Thermal, and Mechanical characteristics account in a large way for the longer life and unexcelled performance of Thomas Porcelain under all conditions.

THE R. THOMAS & SONS CO.
Lisbon, Ohio

Please send me your Catalog No. 40 illustrating Porcelain Insulators and Line Hardware for Distribution Lines.

Name..... Title.....

Address.....

City and State.....

THE R. THOMAS & SONS CO.
LISBON, OHIO
New York - Boston - Chicago

LINEMAN'S TOOL BAG

The safe way to hoist and lower tools, insulators and other supplies. Saves time and materials.

- Heavyweight hard woven canvas.
- Special waterproof flexible leather bottom.
- Rope loop for hanging over pin.
- Non-metallic ring at top.
- Rope holes reinforced with leather inside and outside.
- Spliced rope handle.

Write for folder No. EW-75 covering Safety Accessories for the Electrical Industry

IPCO

Safety Equipment for all Industries

INDUSTRIAL PRODUCTS COMPANY

2820 N. FOURTH STREET • PHILADELPHIA 33, PA.

For Faster, Safer Cable Work

Cable Reel Jack No. 322, with right and left-hand bases; used in pairs. Handles reels up to 7' in dia., and 10-tons in weight. The broad "T" base fitted with three adjustable tie rods affords a firm, non-rocking foundation on all surfaces.

Many manhours are saved by the maximum speed and safety in paying out cable provided by Simplex Cable Reel Jacks. Other screw and lever types, 5 to 15-tons capacity.

Simplex

LEVER · SCREW · HYDRAULIC

Jacks

Templeton, Kenly & Co.

Chicago (44), Illinois

Better, Safer Jacks Since 1899

LETTERS TO THE EDITOR

This Laundry Did Come Up from the Basement

To the Editor of ELECTRICAL WORLD:

In the April 14 issue of ELECTRICAL WORLD I have read with interest on page 111, "The Laundry Comes Up from the Basement." About 20 years ago when we were planning a new house with garage attached it was decided that a laundry over the garage would be a very desirable location. Since the building program had to be abandoned, we bought in 1926 a house with no provision for laundry facilities except in the kitchen or in an impossible cellar.

A 10 ft. by 12 ft. addition two stories high built on this house solved our problem. The first floor was used for a den or sun room and the upstairs space for a laundry. This upstairs laundry has proved to be a joy to my wife and we have often wondered why more people do not consider a similar arrangement, especially when so many houses have built-on garages.

Ninety-five percent of the laundry work comes from the upstairs bed rooms. It follows the usual procedure through the washing machine and tubs, and out on an elevated line across the back yard. This room contains not only the ironing board, but a sewing machine and plenty of closets for all equipment used in connection with a laundry or sewing room. The room also has a comfortable couch for day or night use.

Liberal windows on three sides provide abundant light and ventilation for use as a sleeping porch. A large double "French" window opens wide enough to permit hanging a mattress over the still for beating or "airing." A narrow full height window, hinged on the side, permits entrance into the room of a standard double line from a pulley on a distant telephone pole. One can hang the clothes on the line in-doors and push them outside, a feature much appreciated in freezing weather.

The conveniences of our laundry that came up from the basement to the second floor were the results of ideas of a practical wife plus cooperation of a husband with some mechanical ability and an appreciation of the amount of hard work performed by some women to keep the family in clean apparel with very inadequate equipment.

Although some friends told us we could never sell the house with the laundry upstairs, we have found many

AVOID CABLE ABRASION *with*

STAPUT FAIRLEADERS

"Rubbing at the duct mouth can be reduced by installing fairleaders on the cables at this point."—from Electrical World, May 29, 1943 (Cables—How to Make Them Last).

These non-corrosive alloy cable shields clamp in place to take wear at duct mouth. Easily and safely installed without interruption of service. Eliminate expensive repairs. Use STAPUT FAIRLEADERS. *Write for free catalog.*

Wm. B. Berry Co., 88 North St., Boston, Mass.

NEW

WRITE FOR CATALOG 164

QUICK-START

FLUORESCENT LAMP BALLAST

THE ACME ELECTRIC & MFG. CO.

Cuba, N. Y. Clyde, N. Y.

Acme ACME Electric

TRANSFORMERS

PREMAX

Renew Marking With Metal

Costs less than old-fashioned stenciling and will outlast the pole. Available in standard or special designs.

E

Premax Products

Division Chisholm-Ryder Co., Inc.

4518 Highland Ave., Niagara Falls, N. Y.

CABLEKRETE

Patented protective material for lead covered cables in manholes and tunnels. Resists fire, corrosion, moisture, arcing—adds life to cable. Shipped dry in 11 and 80 lb. bags. Just add water. A money and time saver for utilities. Send for complete information today!

SAKRETE, Inc., 4021 Apple St., Cincinnati 23, O.

CABELUBE

The power cable lubricant that makes cable pulling easier and adds years to its life. Forms protective coating when cable is in place—inhibits corrosion of lead sheath. Packed in 50 lb. units. Send for complete information today!

SAKRETE, Inc., 4021 Apple St., Cincinnati 23, O.

converts to the idea and it certainly has turned out to be a very practical solution to the laundry-sewing room-sleeping porch problem. Other home builders would find it to their advantage to adopt some of the features described.

The upstairs laundry is more than a laundry, it can be made a delightful work-shop for the wife, and a complement to the modern kitchen.

T. W. Gordon,
Schenectady, N. Y.

•

Chinese Industrialization

To the Editor of ELECTRICAL WORLD:

I was very much interested in your article in the May 12 issue of ELECTRICAL WORLD, "Power Supply for Chinese Industrialization Program." Here is an opportunity where new ideas could be very profitably incorporated in the original design of the electrical transmission and distribution systems since, to a certain extent at least, it will probably be necessary to start out from scratch for much of the new construction. My interest in the future of China is more than just professional, it is very personal since I was born in Nanking and spent by early childhood days there.

A. H. Drummond,
Pennsylvania Power & Light Co.
Allentown, Pa.

•

Reliance Reports Net; Backlog of Orders Up

Earnings of Reliance Electric & Engineering Co., Cleveland, for the six months ended April 30, 1945, after reserves for taxes, were $159,806 on shipments of $7,333,600, James W. Corey, president, stated in a recent letter to stockholders. Backlog of orders for the same period increased nearly one and a half million dollars, from $8,280,907 to $9,733,757.

EVERSTICK ANCHORS...

FOR SPEED IN INSTALLATION

The exclusive Everstick nut housing locks the Anchor firmly on the rod. This speeds up installation. Plates are so designed, that they expand easily into undisturbed earth, and extra holding power is achieved. Made of tough, rust-resistant malleable iron. Write for bulletin.

EVERSTICK ANCHOR CO.
FAIRFIELD, IOWA

ONE OF 70 MASTER-LIGHTS

TYPE WS MILE-RANGE HAND SEARCHLIGHT

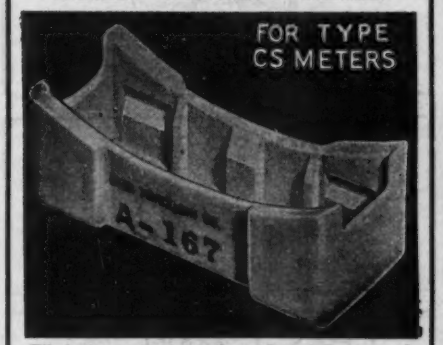
● RECHARGEABLE ●

- LIGHTEST IN WEIGHT
- MOST POWERFUL—MILE RANGE
- LONGEST BURNING HOURS
- ALL NIGHT WORK LIGHT OR
- 150,000 C. P. SEARCHLIGHT BEAM
- SLIP SPARE BATTERY IN PLACE IN 20 SECONDS
- "PERFECT BALANCE" HANDLE

SEND FOR NEW FREE EMERGENCY LIGHTING BULLETIN

CARPENTER MFG. CO.
167 Master Light Bldg.
Boston 45, Mass.
MASTER★LIGHT★MAKERS

STAR METER SEAL

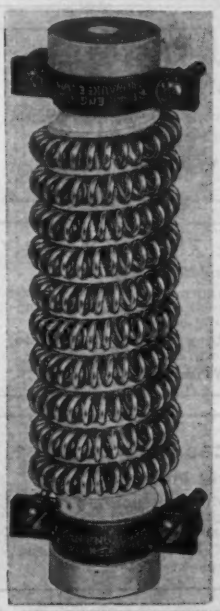


Eliminates meter tampering. Cannot be removed without mutilating. SEND FOR SAMPLE.
STAR PORCELAIN CO.
51 Muirhead Ave. Trenton, N. J.

Do More With Less Help!

SEYMOUR SMITH TELEPHONE PRUNERS

CUT FASTER, COVER MORE GROUND-Keen "Center-Cut" blade slices between two strong side supports. Branch is firmly gripped, quickly cut. Ask for prices.
SEYMOUR SMITH & SON, Inc.
901B Main St., Oakville, Conn.



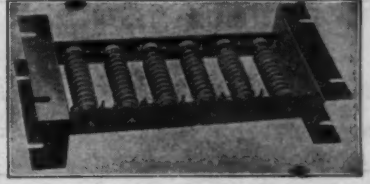
REGAN RESISTOR

- Glazed STEATITE Core
- Shock-tested
- Salt-Water Spray tested

CORE SPECIFICATIONS

20-800°C 8.3x10-6 — Thermal coefficient of expansion per degree Centigrade.
21,000 lbs.—Modulus of rupture in lbs. per sq. in.
5.82—Dielectric constant
.40%—Dielectric loss factor at 1000 kilocycles
.06%—Dielectric power factor at 1000 kilocycles
247 volts — Dielectric strength per mil. thickness
Class "L5" or better —Grade per American War Standards C75. 1-1943
Zero to .005%—Porosity or moisture absorption.

(Left)—Unit Type
(Bottom)—Bank Type



TECHTMANN INDUSTRIES, Inc.
828 N. Broadway, Milwaukee 2, Wis. EW 7
Please rush details on Regan Resistor to
Firm .....
Att'n .....
Address .....
City ..... State.....

PROFESSIONAL SERVICES

CLAUDE ATHERTON
Consulting Electrical Engineer
Transmission-Distribution, Electric Plants, Sub-Stations
Electrical Designs, Plans & Specifications, Industrial Power Layouts
6253 Hollywood Blvd. Hollywood, Calif.

BARKER & WHEELER
Utility and Industrial Valuations, Design and Construction of Power Systems, Water Supplies, Sewerage and Sewage Disposal, Factory Production and Cost Control Systems.
11 Park Place, New York City
36 State Street, Albany, N. Y.

BLACK & VEATCH
Consulting Engineers
Water, Steam and Electric Power Investigations, Design, Supervision of Construction, Valuation, Tests and Laboratory Service.
4706 Broadway, Kansas City, Mo.

E. J. CHENEY AND CO.
ENGINEERS AND CONSULTANTS
Economic and Business Surveys
Valuations and Reports
Rate and Rate Case Analyses
61 Broadway New York

HUGH L. COOPER & CO. INC.
General Hydraulic Engineering, including the design, financing, construction and management of hydro-electric power plants.
350 Fifth Avenue New York 1, N. Y.

DAY & ZIMMERMANN, Inc.
ENGINEERS
Design - Construction - Management
Investigations and Reports
NEW YORK PHILADELPHIA Packard Building CHICAGO

DOBLE ENGINEERING COMPANY
Electrical Insulation Engineers
Field Testing and Maintenance of High Tension Insulation, Special Problems in Electrical Communications.
Office and Laboratory: Medford Hillside, Boston, Mass.
Branch Office: 20 N. Wacker Dr. Chicago, Ill.

Ebasco Services Incorporated
Industrial Division
Design and Construction
Financial and Operating Consultation
Investigations and Reports
Consulting Engineering
Two Rector Street New York

ELECTRICAL TESTING LABORATORIES INC.
Field and Laboratory Tests
Electrical • Mechanical • Physical
Chemical
INSPECTION • ANALYSIS • RESEARCH
CERTIFICATION
2 East End Avenue at 79th St., New York 21, N.Y.

H. F. FERGUSON
Consulting Electrical Engineer
Expert advice on location and purchase of right of way.
Industrial plant layouts & surveys. Rate comparisons.
288 Alameda Avenue Youngstown, Ohio

ROBERT E. FOLEY CONSTRUCTION CORPORATION
Rural Lines—Transmission Lines
Fire Alarms—Telephone Lines
48 Griswold St. Binghamton, N. Y.

FORD, BACON & DAVIS, Inc.
ENGINEERS
DESIGN • CONSTRUCTION
VALUATIONS • REPORTS
New York—Philadelphia—Washington—Chicago

FRANK F. FOWLE & CO.
Electrical and Mechanical
ENGINEERS
35 East Wacker Drive Chicago, Ill.

GILBERT ASSOCIATES, Inc.
Engineers and Consultants
DESIGN, CONSTRUCT, OPERATE & MAINTAIN INDUSTRIALS AND PUBLIC UTILITIES
Reports • Rates • Labor relations • Safety • Purchasing • Costs • Laboratory
61 Broadway New York Reading, Pa. National Press Bldg. Washington, D. C.

FREDERIC R. HARRIS, INC.
ENGINEERS CONSTRUCTORS
MANAGEMENT
NEW YORK
Knoxville Houston San Francisco

HENKELS & McCOY
(Electric & Telephone Line Construction Co.)
Wood pole transmission lines
Electric Distribution and maintenance
Philadelphia, Pa.

HOOSIER ENGINEERING COMPANY
Erecting Engineers
Transmission Lines, Substations
46 So. 5th St., Columbus, Ohio
327 South LaSalle Street, Chicago, Ill.
136 Liberty St., New York

WILLIAM S. LEFFLER
succeeding
CHARLES F. LACOMBE—WILLIAM S. LEFFLER
Engineers—Economists
RATE RESEARCH — SALES RESEARCH
FOR
POST-WAR PLANNING
Cost Analysis Rate Cases
Noroton, Connecticut

LUCAS & LUICK
ENGINEERS
DESIGN, CONSTRUCTION SUPERVISION, OPERATION, MANAGEMENT, APPRAISALS, INVESTIGATIONS, REPORTS, RATES
231 S. LaSalle St., Chicago

CHAS. T. MAIN, INC.
Engineers
Boston, Mass.
Electric, Steam and Hydraulic Projects. Investigations, Reports, Designs and Appraisals.

J. H. MANNING & COMPANY
ENGINEERING SERVICES
120 Broadway, New York

DANIEL W. MEAD F. W. SCHEIDENHELM
Consulting Engineers
Hydro-Electric Development, Dams, Water Supply, Flood Control, Engineering Problems relating to Water Rights and Water Power Law. Appraisals.
New York City, 50 Church St.

ARTHUR L. MULLERGREN
Engineering-Management
Public Utilities—Natural Gas
Kansas City, Mo.

PUBLIC UTILITY ENGINEERING & SERVICE CORPORATION
Consulting Engineers
Design Operations
Steam—Hydraulic—Gas
231 S. La Salle St. Chicago 4, Ill.

Recording & Statistical Corp.
BILL ANALYSIS—CONSUMPTION STUDIES
THE ONE-STEP METHOD
Bill Frequency Analyzer
102 Maiden Lane New York

SANDERSON & PORTER
Engineers - Constructors
FINANCING REORGANIZATION
DESIGN CONSTRUCTION
of
INDUSTRIALS and PUBLIC UTILITIES
Chicago New York San Francisco

SARGENT & LUNDY
ENGINEERS
140 South Dearborn St.
Chicago, Ill.

STONE & WEBSTER ENGINEERING CORPORATION
Design and Construction
Reports • Examinations • Appraisals
Consulting Engineering
BOSTON • NEW YORK • CHICAGO • HOUSTON
PITTSBURGH • SAN FRANCISCO • LOS ANGELES

THE J. G. WHITE ENGINEERING CORPORATION
Design • Construction • Reports • Appraisals
80 Broad Street, New York 4

WHITMAN, REQUARDT AND ASSOCIATES
ENGINEERS — CONSULTANTS
Power Plants — Industrial Plants
Steam and Electric Distribution Systems
Waterworks and Sewerage
Reports—Plans—Supervision—Appraisals
1304 St. Paul Street Baltimore 2, Md.